COOPER Power Systems

Service Information

Form 3A Type ME Electronic Control Installation, Operation, and Testing Instructions

S280-75-1

Applicable to Form 3A Controls above Serial Number 50070

911068KMA-F

Figure 1.
Kyle® Form 3A Type ME Electronic Recloser Control.

Contents

SAFETY FOR LIFE

Cooper Power Systems products meet or exceed all applicable industry standards relating to product safety. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Cooper Power Systems employees involved in product design, manufacture, marketing, and service.

We strongly urge that you always follow all locally approved safety procedures and safety instructions when working around high voltage lines and equipment and support our “Safety For Life” mission.

SAFETY INFORMATION

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians who are familiar with this equipment should install, operate, and service it.

A competent technician has these qualifications:

- *Is thoroughly familiar with these instructions.*
- *Is trained in industry-accepted high- and low-voltage safe operating practices and procedures.*
- *Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.*
- *Is trained in the care and use of protective equipment such as flash clothing, safety glasses, face shield, hard hat, rubber gloves, hotstick, etc.*

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Hazard Statement Definitions

This manual may contain four types of hazard statements:

DANGER: **Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**

WARNING: **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

CAUTION: **Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.**

CAUTION: **Indicates a potentially hazardous situation which, if not avoided, may result in equipment damage only.**

Safety Instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

DANGER: Hazardous voltage. Contact with hazardous voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high and low voltage lines and equipment. G103.3

WARNING: Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling or maintenance can result in death, severe personal injury, and equipment damage. G101.0

WARNING: This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury and equipment damage. G102.1

WARNING: Power distribution equipment must be properly selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install, or maintain power distribution equipment can result in death, severe personal injury, and equipment damage. G122.2

PRODUCT INFORMATION

Introduction

Service Information S280-75-1 provides installation instructions, operation information, and testing procedures for the Kyle® Form 3A Type ME electronic recloser control.

This control is used in conjunction with a Kyle electronically controlled recloser. If used with a Type VWE, VWVE27, VWVE38, WE, or WVE recloser, refer to *Service Information S280-40-2*. If used with a VSA12, VSA16, or VSA20 recloser, refer to *Service Information S280-45-1*. If used with a VSO12, VSO16, or VSO20 recloser, refer to *Service Information S280-57-1*.

The information contained in this manual is organized into the following major categories: Safety Information, Product Information, Programming and Operating the Control, Installation Procedure, Testing, and Maintenance Information. Refer to the table of contents for page numbers.

Read and understand the contents of this manual and follow all locally approved procedures and safety practices before installing or operating this equipment.

Additional Information

These instructions do not claim to cover all details or variations in the equipment, procedures, or process described nor to provide directions for meeting every possible contingency during installation, operation, or maintenance. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact your Cooper Power Systems sales engineer.

Acceptance and Initial Inspection

Each control (Figure 1) is completely assembled, tested, and inspected at the factory. It is carefully calibrated, adjusted, and in good condition when accepted by the carrier for shipment.

Upon receipt, inspect the control thoroughly for damage and loss of parts incurred during shipment. If damage or loss is discovered, file a claim with the carrier immediately.

Handling and Storage

Take care during handling and storage to minimize the possibility of damage. If the control is to be stored for any length of time before installation, provide a clean, dry storage area. If storage is in a humid atmosphere, make provisions to keep the cabinet heater energized.

Note: To energize the cabinet heater, apply to 120 Vac to Terminals 5 and 6 of the input terminal strip mounted vertically on the back panel of the control cabinet. Refer to Figure 4.

Control Battery Storage and Charging

The nickel-cadmium control battery is fully charged prior to shipment and is ready for use. The battery should only be stored in a fully charged state. Permanent irreversible damage will result if a battery is stored in a deeply discharged state. The battery should be kept on a maintenance charge of 15 mA until the control is put into service. After three months of storage, check the open circuit voltage. The battery will require recharging if it is at or below 24 volts at 25˚C (77˚F). Never store batteries at temperatures exceeding 47˚C (117˚F), as permanent damage can result in one month. Storage at or below room temperature is recommended to prolong storage time and maintain capacity over time.

IMPORTANT: The battery must be disconnected prior to shipping or storing the control.

IMPORTANT: Connect the control battery when AC power is connected to the control's AC supply Input Terminal Block.

To maintain the battery charge, energize the control's built-in charger with AC power applied to the input terminal block. If it is not possible to charge the battery with the control's built-in charger, a portable dual rate bench type charger, catalog no. KA1142ME3, is available. The charger provides a selectable output of either 15 mA for maintaining a charged battery or 50 mA for charging a discharged or partially discharged battery. Unless it the battery is known to be fully charged, it should be charged at 50 mA for 48 hours (CHARGE switch position) and then maintained at 15 mA (MAINTAIN switch position) until the battery is installed in the control and put into service.

Battery Connections

When the battery is shipped from the factory, the battery source is disconnected and its output plug is taped to the cabinet. Connect the battery plug into the mating connector to complete the battery circuit.

Minimum-Trip Resistors
Establish the minimum-trip current levels for ground and each phase; cartridges are marked in primary amps and clamped in place.

Ground-Trip Selector
Programs the number of fast ground-trip operations as defined by the timing plug in Socket 1; the remaining (slower) operations to lockout are defined by the plug in ground-trip Socket 2.

Lockout Selector
Programs the total number of operations to lockout.

Phase-Trip Selector
Programs the number of fast phase-trip operations as defined by the timing plug in Socket 1; the remaining (slower) operations to lockout are defined by the plug in Phase-trip Socket 2.

Reclosing Interval Plugs
Determines the delay interval for each closing operation. The delay value is determined by the position of the plug in the socket adapter. An instantaneous plug is available for the first reclose interval only.

Operation Counter
Records the cumulative trip operations of the control.

Ground-Trip Timing Plugs
Provide a variety of current-integrated timing curves on individual plugs for coordinating the ground-trip operation with backup and downline protective devices.

Sequence Relay
Steps the control through its operating sequence.

Phase-Trip Timing Plugs
Provide a variety of current-integrated timing curves on individual plugs for coordinating the phase-trip operation with backup and downline protective devices.

Ground-Trip Operation Switch
Blocks all ground tripping in the BLOCK position: Prevents unintentional tripping during single-phase switching operations.

Reset-Delay Plug
Determines the delay interval before the control resets after a successful reclosure during an operation sequence. The delay value is determined by position of the plug in the socket adapter.

Manual Control Switch
In the TRIP position, it locks out the control, advances the sequence relay to lockout, and disconnects the battery from the control circuits. In the CLOSE position, it moves the sequence relay to the home position, reconnects the battery, and closes recloser. If held in the CLOSE position, it will override cold-load inrush; however, the control will lock out for permanent faults.

Battery Test Terminals
Enable checking battery voltage, charging rate, and quiescent battery current drain.

Lockout-Indicating Signal Lamp
Provides visual indication of control lockout.

Control Fuse
Protects the closing solenoid coil (on reclosers that employ solenoid closing) if closing voltage is too low. Connected in series with the closing contactor in the recloser on motor-operated units; connected in series with the contactor rotary solenoid on reclosers that employ solenoid closing.

Non-Reclosing Switch
Sets the control for one-trip to lockout without disturbing the lockout setting of the operations selector.

Lamp Test Lockout Switch
Enables testing the signal lamp and checking for control lockout.

911068KMA-E

Figure 2.
Front Panel of Form 3A Control.

Description of Control

The Kyle Type ME Form 3A electronic recloser control is comprised of a number of programmable, solid-state electronic circuits that perform the command functions involved in automatic recloser operation.

Control Panel

A swing-out front panel contains the programming and operating elements of the control (Figure 2). The upper, black portion of the front panel contains the plug-in components and setting knobs for programming automatic recloser operation. The switches and indicators used for manual operation and service are grouped on the bottom, light portion of the panel.

Tie Board

The front panel is backed by a printed-circuit tie board which supports and interfaces the plug-in circuit boards with other related circuit components (Figure 3). Program-altering, remote-control, indicating, and general convenience accessories can be added to further expand and enhance the application capabilities of the control.

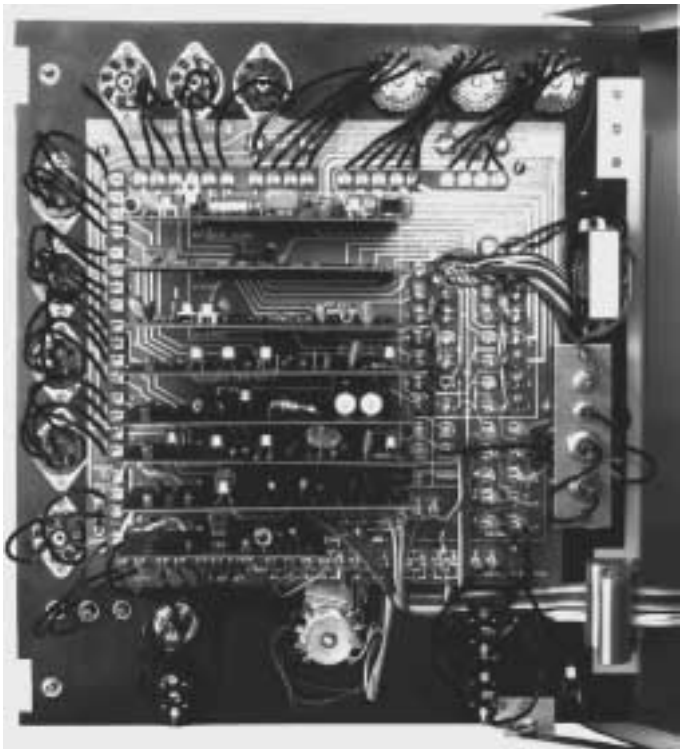

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Figure 3.
Tie Board on Back of Front Panel Mounts the Individual Printed Circuit Boards.

Phase- and Ground-Trip Protective Feature

The phase- and ground-trip protective feature extends the maximum fault-current capability of the ME control to the maximum interrupting rating of the recloser.

The phase- and ground-trip protection feature consists of four Zener diodes bracket-mounted to the back panel alongside the tie board (shown in Figure 3).

Back Panel

The control battery, cabinet heater, surge module for auxiliary power supply, customer connections terminal strip, and accessory boards are located inside the control cabinet and on the back panel of the control as shown in Figure 4.

Description of Control Operation

Line current flowing through the recloser is sensed by three internally mounted bushing-current transformers in the recloser, one on each phase. When the phase current or the zero-sequence (ground) current exceeds its programmed minimum-trip value, the electronic control initiates the programmed sequence of recloser tripping and reclosing operations. If the fault is temporary, the control ceases to command recloser operations after the successful reclosing, and the control resets to the start of its operating sequence after a preset time delay. If the fault is permanent, the control performs its complete programmed sequence of recloser commands and locks out with the recloser open. Once locked-out, the control must be manually reset to the start of its operating sequence, which simultaneously closes the recloser.

Factory-calibrated timing plugs establish the time–current characteristics for both phase and ground tripping. A set of two individual timing curves provides dual timing for both phase and ground.

A functional block diagram of the control operation is shown in Figure 5. Line current conditions are monitored continuously by three bushing-type current transformers in the recloser, one on each phase. Output of these transformers is fed to the trip network in the control, which includes the minimum-trip resistors, isolation transformers, and rectifier circuits.

When current above the selected minimum-trip level is detected in one or more phases, the following chain of events will occur for an operating sequence of two fast and two delayed operations:

The overcurrent signal is integrated with time on the characteristic curve of the timing plug in Socket 1 to produce the signal which energizes the trip circuit. Energizing the trip circuit connects the battery to the trip solenoid to trip open the recloser. Simultaneously, the sequence relay advances to energize the first reclosing interval-delay plug. Upon expiration of this reclosing interval delay, a closing signal from the control closes the recloser, and the sequence relay sets up the circuitry for the second fast trip operation.

If current remains above the minimum-trip level, the tripping—reclosing sequence of fast and delayed operations is repeated, as programmed, to lockout.

If the overcurrent is cleared before the operating sequence reaches lockout, the reset-delay circuit starts timing when the recloser closes into the un-faulted line. When the reset-delay plug times out, the sequence relay is reset to the start or home position and the control is ready for another two-fast, two-delayed trips operating sequence. However, should the fault recur before the reset plug times out, the control will continue its operating sequence where it left, and the reset delay timing will be erased.

Ground-fault sensing and tripping operations occur exactly the same as phase sensing and tripping, except that zero-sequence (ground) current is sensed instead of phase current. The ground-fault circuitry includes its own minimum-trip resistor, fast and delayed trip timing plugs, and number of fast operations setting. Reclose and reset intervals and operations to lockout are common for both phase-trip and ground-trip modes of operation.

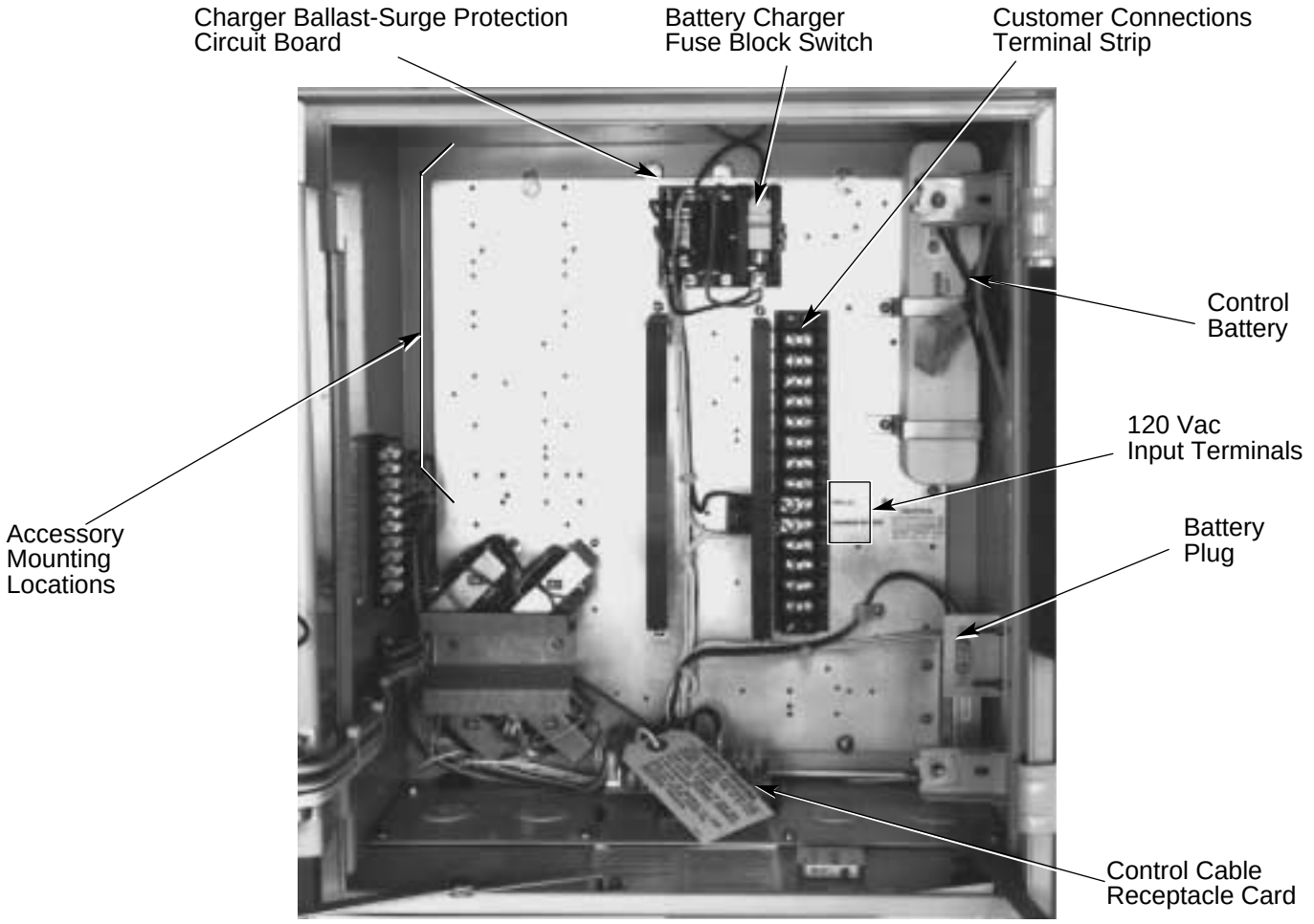

Figure 4.
Inside Back Panel of Form 3A Control.

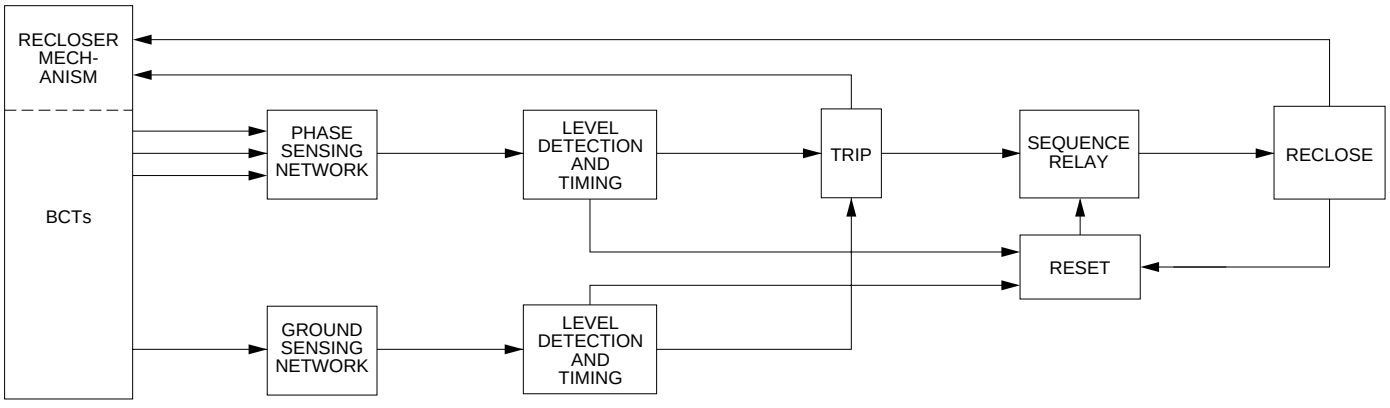

Figure 5.
Functional Block Diagram of Form 3A Control.

Control Battery

Power to operate the tripping and reclosing solenoids in the recloser is provided by a 24 volt, nickel-cadmium battery located in the back, upper right corner of the control cabinet. A temperature-regulated 120 Vac potential battery charger, built into the control circuitry, provides a temperature compensated charging current to the battery. **All Form 3A controls require a 120 Vac input to the control to energize the battery charger.**

If 120 Vac cannot be provided to the control, the recloser must be equipped with a factory-installed battery charger accessory.

A. In solenoid-operated reclosers (RVE, RXE, VWE, VWVE27, VWVE38, WE, and VWE) a BCT accessory must be added to the recloser to obtain charging power from the line.

Note: Line current flow through the recloser must be a minimum of 40 amps for at least 12 hours per day to provide sufficient charging power.

B. In motor-operated reclosers (CXE, VSA12, VSA16, VSA20, VSO12,VSO16, and VSML), a potential-type battery charger accessory must be added to obtain charging power from the 240 Vac auxiliary power source of the recloser.

Battery Check Procedures

Follow the check battery procedures to check the battery voltage, quiescent drain, and charging rate. The values in the test procedure is based on testing at 25˚ C (77˚ F).

Note: The control does not need to be connected to a recloser for the battery check tests.

CAUTION: Recloser misoperation. The control must be removed from service before disconnecting the control battery. Disconnecting the control battery from an in-service control may cause recloser misoperation (unintentional operation). Failure to comply can result in equipment damage and personal injury. T213.4

CAUTION: Equipment damage. Shorting battery positive to battery negative at the battery test terminals on the control panel will cause damage to the control. The control will be inoperative and possible misoperation (unintentional operation of the recloser) can result. T214.1

IMPORTANT: Battery voltage and charge current measurements can be made while the control is in service, from the test terminals provided on the face of the control panel. The control must be taken out of service for all other battery maintenance, battery replacement, or battery drain tests.

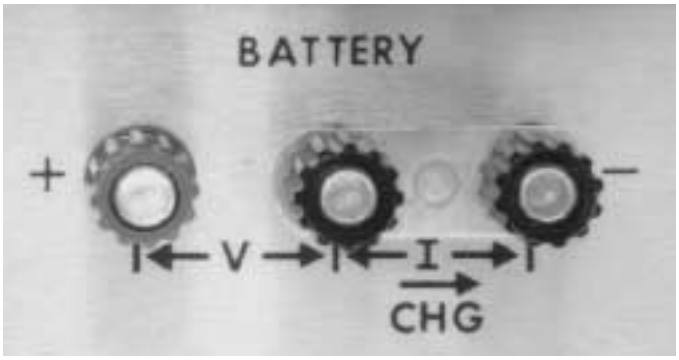

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Figure 6.
Battery Test Terminals.

Check Battery Voltage Procedure

1. Remove the control from service. Refer to the **To Remove Control from Service** section in this manual.
2. Disable the control battery charger by opening the fused switch or removing the AC power from the control. Wait 3 to 5 minutes to allow the battery voltage to stabilize prior to testing the open circuit battery voltage.
3. Three battery test terminals in the lower right corner of the front panel are used to check the battery voltage, quiescent drain, and charging rate (Figure 6). The left hand pair of terminals (V) are connected directly across the battery to check battery voltage. The red terminal (far left) is battery positive (+).
4. The battery in the control will experience a steady drain of approximately 1.5–2.5 mA (may be as high as 4.5 mA with certain accessories).
5. Measure the battery voltage from the battery test terminals on the control front panel. If battery voltage is below 24 volts, the battery is either low on charge or failing. The battery should be removed for recharging and retested before returning to service.
6. If battery voltage is above 24 volts, perform the following load test. While measuring battery voltage, connect a 10Ω, 10 watt resistor across the battery test terminals for approximately 2–3 seconds. For ambient temperatures above -6˚C (20˚F), battery voltage should drop by no more than 3 volts from the open circuit voltage.

   Note: Either a KA638ME voltmeter accessory or a KMET Tester can be used for the load test. Both devices have a built in 10Ω load resistor.

7. If the temperature is below -6˚C (20˚F), the battery voltage/temperature should follow the lower curve in *Service Information S280-75-2 Figure 53*. If the voltage falls below the lower curve, the battery should be removed for bench testing.

Table 1
Quiescent Battery Drain Above Normal

DESCRIPTION	DRAIN (mA)
3-second reset plug	2.3
10-second reset plug	0.8
Sequence coordination accessory (when control is in home position)	0.8
Remote minimum-trip doubler (supervisory contacts closed)	6
Targets	1.9

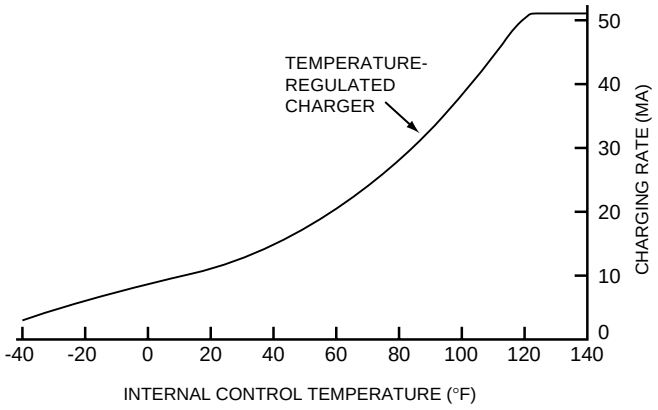


Figure 7.
Comparison of Charging Rates.

Check Battery Quiescent Drain and Charging Rate Procedure

The righthand pair of terminals (-I-) are connected in series with the negative battery lead to check quiescent drain and charging rate. Proceed as follows:

1. Remove the control from service. Refer to the **To Remove the Control from Service** procedure in the **Programming and Operating the Control** section of this manual.
2. Set the control to the home (reset) position by moving manual operator to CLOSE.
3. Plug a dc milliammeter into the current test terminals. Loosen both terminals slightly and disconnect the shorting link from between terminals.
4. With the battery charger **de-energized**, current will flow opposite to the direction shown by CHG. Under normal conditions, quiescent drain will be 1-1⁄2 to 2 mA. However, the shorter time reset plugs and certain accessories can, as shown in Table 1, increase the quiescent drain above nominal value.

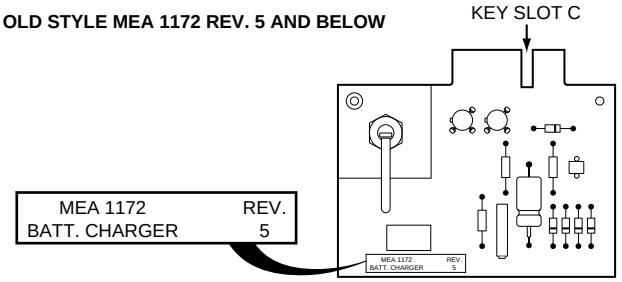
   Note: To verify the charge/discharge polarity of the test meter, momentarily actuate the LAMP TEST/LOCK-OUT TEST toggle switch to LAMP TEST. The discharge current is measured.
5. With the battery charger energized, current will flow in the direction shown by CHG. The charging circuit used in the control is temperature regulated. The charging rate will vary depending on the internal control temperature, see Figure 7.
6. Replace and tighten the shorting link between the current terminals before removing the ammeter.

   Note: Bypass diodes in the battery circuit prevent the control from being disabled if the link is inadvertently left open.

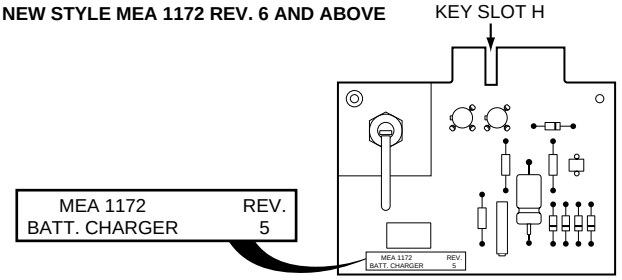
IMPORTANT

Beginning with control serial number 53381, the key slot position of the battery charging board socket has been changed. The key slot on the temperature-regulated charging board (MEA1172, 120/240 Vac) has been moved to match the socket arrangement. The new charging board can be identified by the revision 6 or above marking adjacent to the part number. A blue label affixed to the accessory list location guide label, inside the control door, identifies the new temperature-regulated battery charging board.

OLD STYLE MEA 1172 REV. 5 AND BELOW



NEW STYLE MEA 1172 REV. 6 AND ABOVE



Note: Controls equipped with CT or potential charger in the recloser are unaffected by this change. They will continue to use the MEA 388-1 charging board, with the key in the original position.

Temperature-Regulated Battery Charger

All Form 3A Type ME controls, serial number 50070 and above, are equipped with a temperature-regulated battery charger as standard equipment.

Description

The temperature-regulated battery charger provides protection against battery drain and premature battery failure at high ambient temperatures. As the temperature increases, the self discharge rate of the control battery increases. The temperature-regulated battery charger compensates for this self-discharge by providing higher charging rates at higher temperatures.

Operation

The temperature-regulated battery charger consists of a charger ballast-surge protection card and a plug-in battery charger circuit board. It provides an increased charging rate proportional to the temperature inside the control cabinet (see Figure 7).

PROGRAMMING AND OPERATING THE CONTROL

The Form 3A control is preset at the factory for an automatic sequence of operations as specified on the order and should not be disturbed by unauthorized personnel. Changes in the control operating parameters should be made only by a qualified technician or engineer. The control must be removed from service prior to making any changes to programmed settings.

CAUTION: Equipment misoperation. Do not connect this control to an energized recloser until all control settings have been properly programmed and verified. Refer to the programming information for this control. Failure to comply can result in control and recloser misoperation, equipment damage, and personal injury. G110.3

CAUTION: Equipment damage. Never operate the control without a full set of proper circuit boards and time-current curve plugs in the no. 2 trip-timing sockets for both phase and ground. Failure to comply will result in misoperation of the control and recloser. T215.1

The plug-in components and selector switches for programming the control are located on the black, upper portion of the control panel.

To Remove the Control from Service

Prior to changing plug-in components, performing control maintainence, making programming changes, or replacing the battery on an in-service control, the following steps must be taken to prevent possible recloser misoperation.

1. Switch Ground Trip Block switch to BLOCK.
2. Disconnect control cable from control.
3. De-energize potential battery charger, by opening the battery charger fuse block switch (shown in Figure 4).
4. Operate the Manual Control switch to OPEN.
5. Unplug the control battery.

To Return the Control to Service

After required work is completed, return the control to service with the following steps:

1. Check that all plug-ins are properly installed and control settings are correct.
2. Connect control battery.
3. Close the battery charger fuse block switch to energize the potential battery charger.
4. Move Manual Control switch to CLOSE, to ensure that control is reset to the home position.
5. Reconnect the control cable to the control.
6. Switch Ground Trip Block switch to NORMAL.

IMPORTANT: Battery voltage and charge current measurements can be made while the control is in service from the test terminals provided on the face of the control panel. The control must be taken out of service for all other battery maintenance, battery replacement, or battery drain tests.

Number of Operations Selectors

The three selector knobs in the upper left corner of the panel (Figure 8) establish the operating sequence of the control. From one to four total operations to lockout can be selected on the center LOCKOUT knob. GROUND TRIP SOCKET [1] selector knob to the left establishes the number of ground trip operations (0 to 4) according to the time–current characteristic curve of the timing plug in GROUND TRIP SOCKET [1]. The balance of the ground-trip operations to lockout are then performed according to the characteristic curve of the timing plug in GROUND TRIP TIMING SOCKET (2).

PHASE TRIP SOCKET ◇1◇ selector knob to the right performs the same function for phase-trip sequence selection.

911068KMA-A

Figure 8.
Ground-Trip, Lockout, and Phase-Trip Operation Selectors.

Reclosing Interval Timing Delay Selectors

Depending upon the number of operations to lockout, one, two, or three reclosing intervals (each individually timed) can be programmed. The reclosing intervals are established by the solid-state timing plugs in the upper right corner of the panel (Figure 9). Times of 1, 2, 5, 7, 10, 15, 30, and 45 seconds are available on a multiple-setting plug (Figure 9). The small white arrow at the top of the plug indicates the value selected. Selection is determined by the position of the plug in the socket adapter (Figure 10). INST (instantaneous) and 60 second, single-value plugs are also available. Single value plugs do not use the socket adapter.

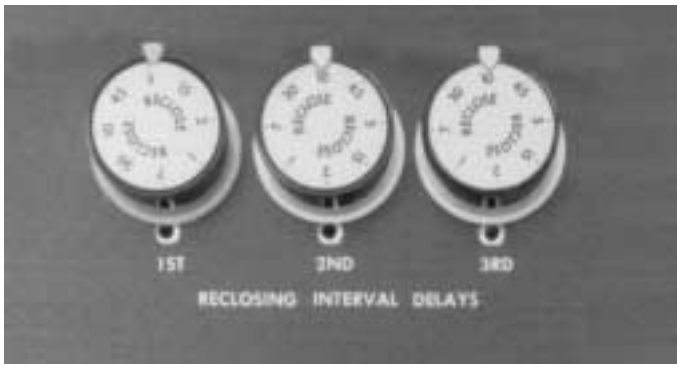


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Figure 9.
Reclosing Interval Plugs with Multiple Delay Settings.

The INST reclosing interval plug may be used only in the first reclosing interval socket. The instantaneous reclosing interval time will vary depending upon the recloser on which the control is used; the approximate values are:

CXE recloser ..... .67 sec.

ME recloser ..... .63 sec.

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Figure 10.
Time is Determined by Position of Plug in Socket Adapter.

RVE, RXE, VWE, VWVE27, VWVE38, WE, WVE reclosers ..... .67 sec.

VSA12, VSA16, VSA20, reclosers ..... .50 sec.

The INST reclosing interval plug must not be used with the Type VSO recloser. No reclosing interval shorter than 1⁄2 second should be programmed into the Type ME control when it is used with the Type VSO recloser. A 1⁄2 second reclose plug is available (ordered by KA1177ME-1). If an instantaneous (INST) plug is used for the first reclosing interval, it will result in a 12 cycle reclosing time, which may be too short to permit arc deionization at the fault location.

Minimum-Trip Resistor Cartridges

The recloser minimum-trip current ratings are established with the plug-in resistor cartridges in the center of the control panel. The cartridges, labeled with their minimum-trip-current values, are identified for GROUND TRIP (one required), or PHASE TRIP (three required). All three phase-trip cartridges should have the same current rating.

All Kyle electronic reclosers, except VSA20, VS020, and discontinued Types ME and VSMT, use a yellow label minimum-trip resistor cartridge. Blue label cartridges are used with 2000:1 sensing CTs in the higher current rated VSA20 and VS020 reclosers and are not interchangeable with yellow label resistors.

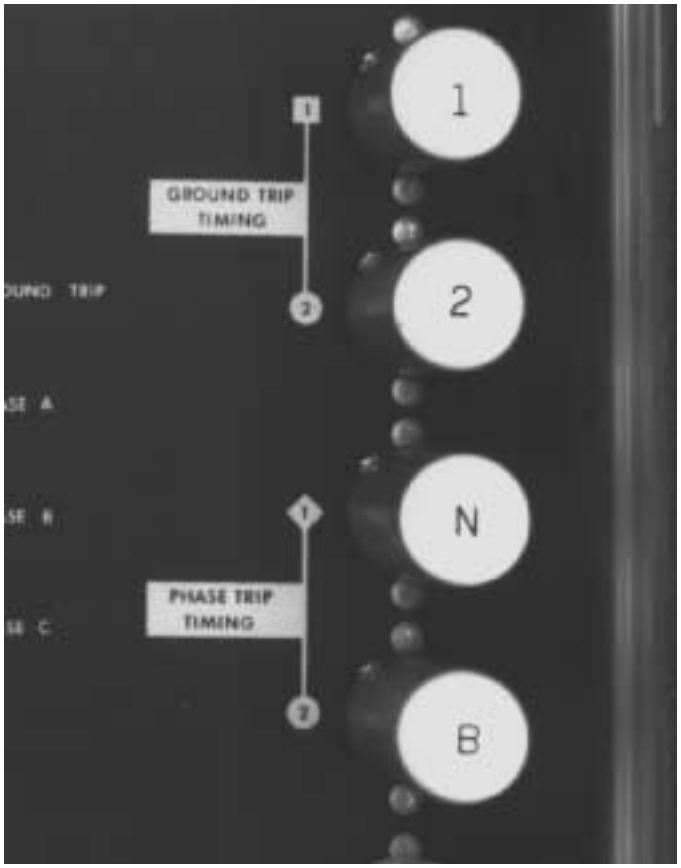

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Figure 11.
Ground-and Phase-Trip Time-Current Curve Plugs.

Yellow label minimum-trip resistor cartridges are available in the following minimum-trip-current ratings:

Ground: 25, 35, 50, 70, 100, 120, 140, 170, 200, 240, 280, 340, 400, 480, and 560 amps;

Phase: 100, 120, 140, 170, 200, 240, 280, 300, 340, 400, 480, 560, 600, 800, 960, and 1120 amps.

Blue label cartridges are available in the following minimum-trip-current ratings:

Ground: 100, 140, 200, 240, 280, 340, 400, 480, 680, 800, 960, and 1120 amps;

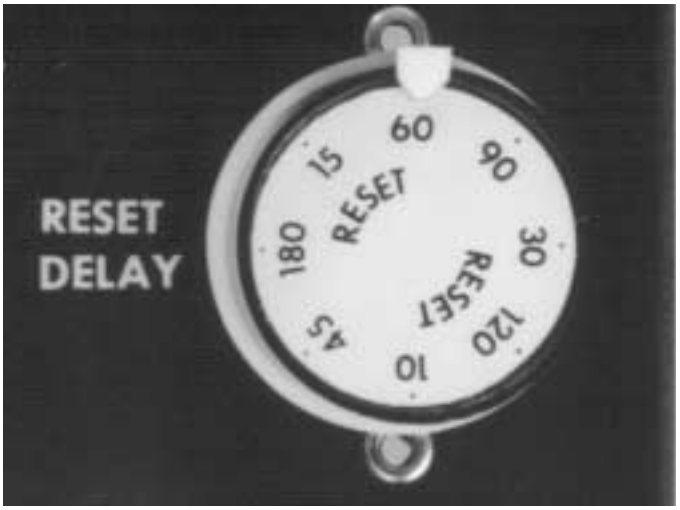
Phase: 200, 240, 280, 340, 400, 480, 560, 600, 680, 800, 960, 1120, 1200, 1360, 1600, 1920,and 2240 amps.

Ground- and Phase-Trip Timing Plugs

Time-current curves for both phase and ground tripping are established by the four plugs along the right edge of the control panel (Figure 11). Individual plugs for 20 phase-trip timing curves and 16 ground-trip timing curves are available. (See *Reference Data TCC Index R280-91* for time-current curves).

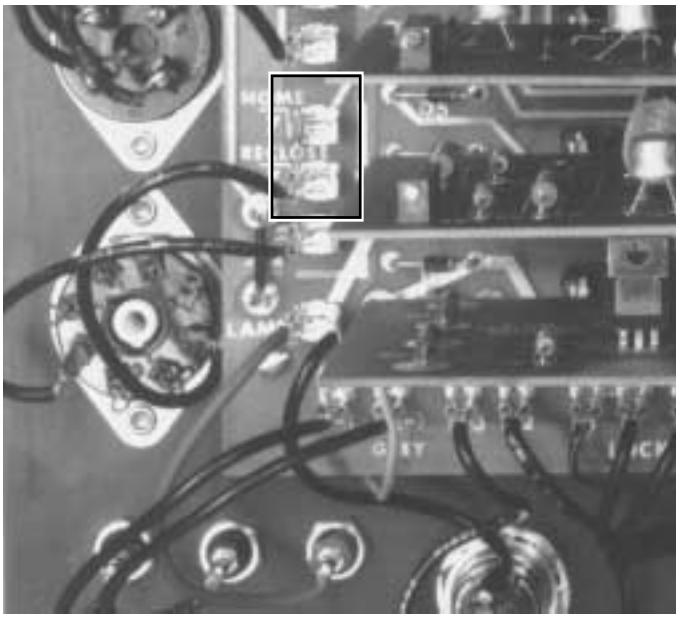
! CAUTION: Recloser misoperation. Ground- and Phase-trip timing plugs are not interchangeable. They must only be installed in the corresponding sockets. Failure to comply will cause misoperation of the control. T217.1

When dual-timing operation is programmed, the timing characteristic curve in Socket 1 always precedes the curve in Socket 2. When single-timing operation is programmed, the timing plug is installed in Socket 2 and the number of fast operations selector knob is set on zero.



86847KMA-B

Figure 12.
Reset Delay Selector.



911069KMA-B

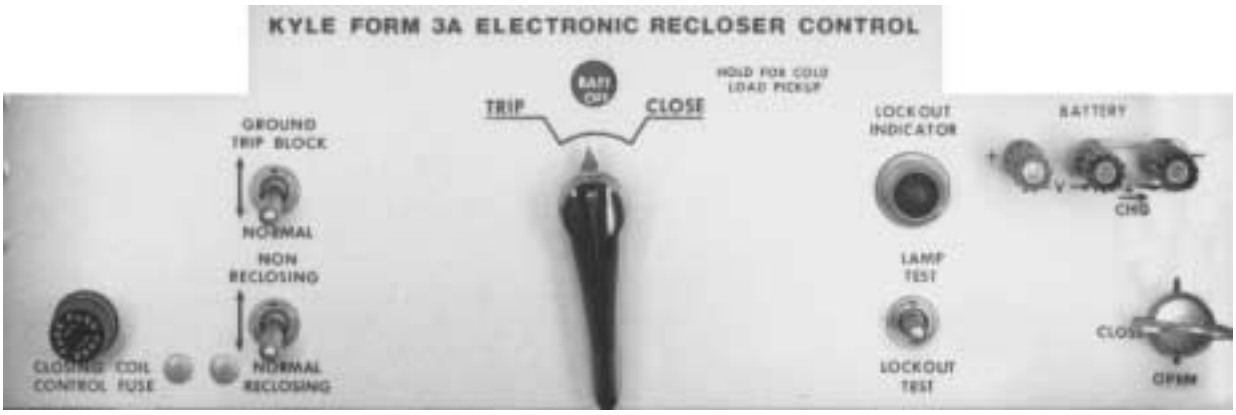
Figure 13.
Control Operation can be changed from "reset-timed-from-successful-reclose" (standard) to "reset-timed-from-first-trip-operation."

! CAUTION: Recloser misoperation. Socket 2 must always be provided with a timing plug; otherwise phase tripping is blocked and ground tripping may be instantaneous. T218.1

Reset Delay Selector

For temporary faults that are cleared before lockout occurs, reset timing starts after a successful reclosure (current is below minimum trip). The reset time is established by a timing plug similar to, but not interchangeable with, the reclosing interval plug. The reset delay plug (Figure 12) is located on the lower right hand portion of the control panel. Times of 10, 15, 30, 45, 60, 90, 120, and 180 seconds are available on a multiple setting plug and are determined by the position of the plug in the socket adapter (Figure 10). A 20 second, single-value plug is also available.

Note: The selected reset delay time must be longer than the longest reclosing interval of any load- or source-side protective device with which the recloser is to coordinate.



9110068KMA-CD

Figure 14.
Lower Portion of Front Panel of Control.

Reset Timed from First Trip Operation

The Form 3A control can be converted to reset-timed-from-first-trip operation, if so desired, by removing a jumper on the tie board and moving a lead from the push-on tab labeled RECLOSE to an adjacent tab labeled HOME (Figure 13). However, under this reset mode, the time selected must exceed the longest possible tripping and reclosing sequence that can be experienced. Minimum-fault currents (which provide the longest tripping times) must be considered.

Operating Switches and Indicators

The switches and indicators for manual operation and service are grouped on the lower, light colored portion of the control panel (Figure 14).

Manual Control Switch

Located in the center of the lower panel, the manual control switch enables manual closing and tripping of the recloser. Moving the switch to TRIP opens the recloser, locks out the control, and disconnects the battery from the control circuits. Moving the switch to CLOSE reconnects the battery, resets the control to home, and closes the recloser.

A cold-load pickup feature is built into this switch. Holding the switch in CLOSE will disconnect the no. 1 timing plug for both phase and ground trip and set the control to operate on the slower no. 2 plugs. While the switch is held in this position, the control is still free to trip and lock out if closed into a fault. However, all operations to lockout will occur on the no. 2 trip-timing plugs.

Ground-Trip Operation Switch

The ground-trip operation of the control is disabled when this switch is set to BLOCK. Blocking ground-trip operations is useful during known periods of three-phase load unbalance and while performing single-phase testing or switching.

Non-Reclosing/Normal Reclosing Switch

WARNING: This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury and equipment damage.

G102.1

To meet specific local safety requirements during startup or service restoration, the control can be set to block reclosing after an automatic trip (one-shot-to-lockout-operation) by setting the operating mode switch to NON-RECLOSING. Returning this switch to NORMAL RECLOSING after a successful reclose will ready the control for its full programmed operating sequence.

Lockout Indicator

Verification of control lockout consists of an indicator lamp and a momentary double-throw toggle switch. In the LOCKOUT TEST position, the lamp will light if the control is locked out; the LAMP TEST position verifies the condition of the lamp.

IMPORTANT: The lockout indicator will only accurately reflect the state of the control. It does not monitor the recloser mechanism and may not accurately reflect the position of the recloser contacts.

Proper verification of the recloser status must include examination of both the control lockout indicator and a visual check of the position of the mechanical contact position indicator on the recloser.

Battery Terminals

These terminals provide a means for checking the condition of the battery. Refer to the **Battery Check Procedures** in the **Control Battery** section in this manual.

Closing Coil Control Fuse

On solenoid-operated reclosers, the fuse will open the closing circuit to protect the potential closing coil in the recloser if closing cannot be accomplished due to low closing voltage. On motor-operated reclosers, the fuse is connected in series with the closing circuit contactor in the recloser.

A Buss Type MDQ-3/8 amp, 250 volt fuse, manufactured by Bussman Manufacturing is used and a box of five spare fuses is supplied with each control. Fuses of similar ratings by other manufacturers have slightly different characteristics and should not be used for replacement.

IMPORTANT: Use only Buss Type MDQ-3/8 amp fuses. Until 1988, all Form 3A and most earlier controls were supplied with Buss Type MDL-3/8 amp fuses. Buss has redesigned and changed the characteristics of that fuse and it is no longer suitable for use on any Form 3 or Form 3A control. Failure to use proper closing coil control fuse will result in unnecessary fuse operation and prevent the recloser from closing.

Note: In 1988, Buss redesigned the MDL-2.5 amp fuse that is used on controls shipped with reclosers having "quick-close" mechanisms such as Type VSO reclosers. The characteristics of the new single element MDL-2.5 fuse do not affect the application in the control. Buss will also continue to manufacture the original dual element version of the fuse under the new designation of MDQ-2.5. The MDQ-2.5 amp fuse will be supplied with controls for this application. Both the MDL-2.5 amp fuse and the MDQ-2.5 amp fuse are acceptable for this application.

INSTALLATION PROCEDURE

This control is used in conjunction with a Kyle electronically controlled recloser. Installation instructions for the recloser are packed with the recloser. Refer to the appropriate recloser installation manual when installing the control and recloser.

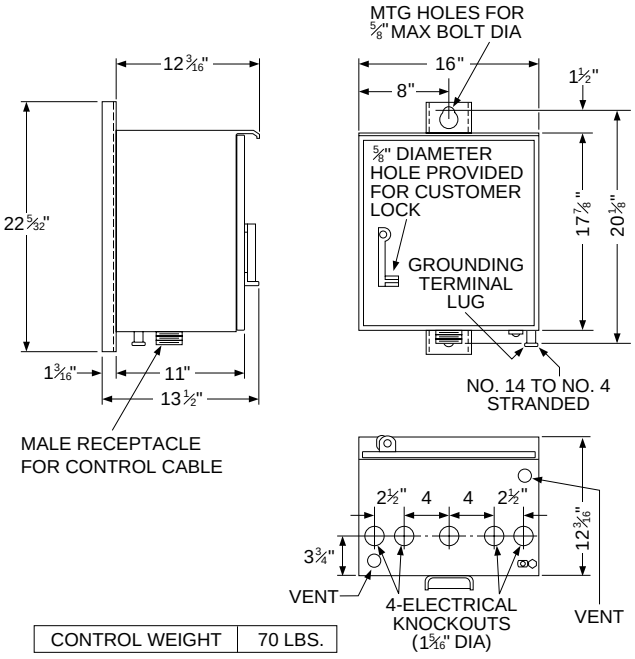
Mounting the Control

The Form 3A Type ME electronic recloser control can be mounted at any convenient, accessible location near, or remote from, the recloser.

1. For pole-mounted installations, this is normally near the base of the pole.
2. For substation installations, brackets are available as a mounting frame accessory for mounting the control to the substation frame.

Limits on control cable length determine the maximum distance between the control and recloser: up to 125 feet for solenoid-operated reclosers RVE, RXE, VWVE27, VWVE38, WE, WVE; up to 35 feet for motor-operated reclosers CXE, VSA12, VSA16, VSA20, and VSML.

Outline, mounting, and knockout dimensions are shown in Figure 15 for the standard control cabinet and Figure 16 for the double-size control cabinet.



CONTROL WEIGHT	70 LBS.

Figure 15.
Standard Cabinet Mounting Dimensions.

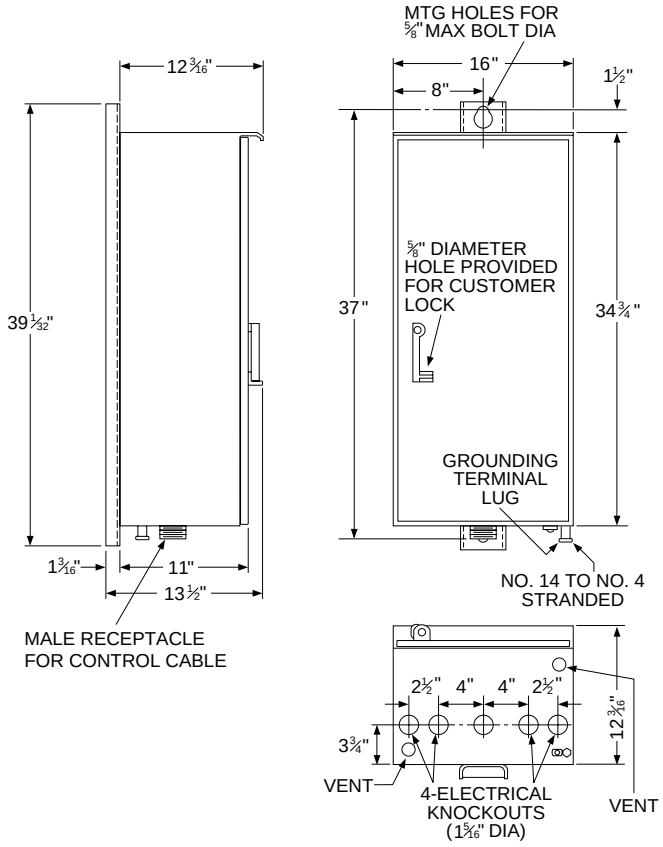


Figure 16.
Double-size Cabinet Mounting Dimensions.

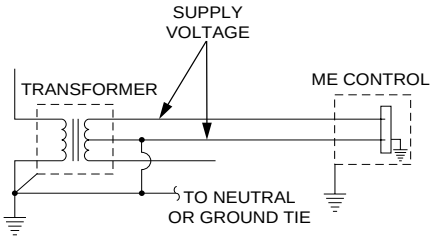
Grounding the Control

The control cabinet must be grounded. A grounding connector on the underside of the cabinet will accommodate no. 14 solid through no. 4 stranded conductors. (Figures 15 and 16). Be sure to follow all locally approved grounding procedures when installing the control. Suggested methods for grounding the control are shown in Figures 17 and 18.

The installation must meet the following requirements:

1. The recloser and transformer are protected with lightning arresters.
2. The transformer tank is grounded.
3. The recloser head is grounded.
4. Secondary cables must be shielded or Triplex cables.

Note: If the control is mounted on a recloser frame which itself is grounded, a separate lead from the cabinet to earth ground is not required but may be added.



ELECTRICAL CONNECTIONS

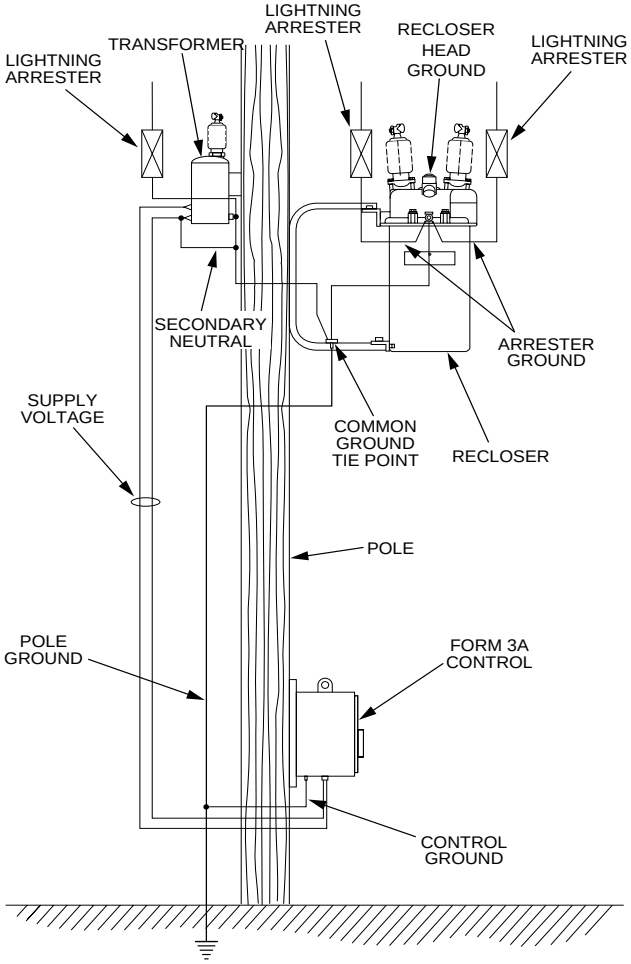
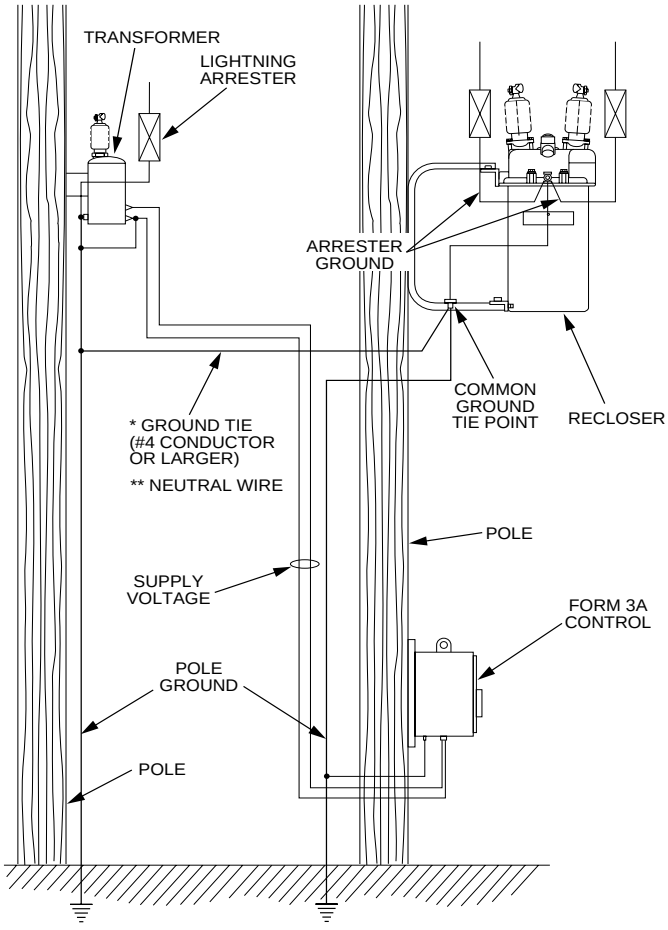


Figure 17.
Recommended Grounding Method for Form 3A Control with Local Supply Voltage Transformer.



*3 WIRE UNIGROUNDED SYSTEM

** 4 WIRE SYSTEM

Figure 18.
Recommended Grounding Method for Form 3A Control with Remote Supply Voltage Transformer.

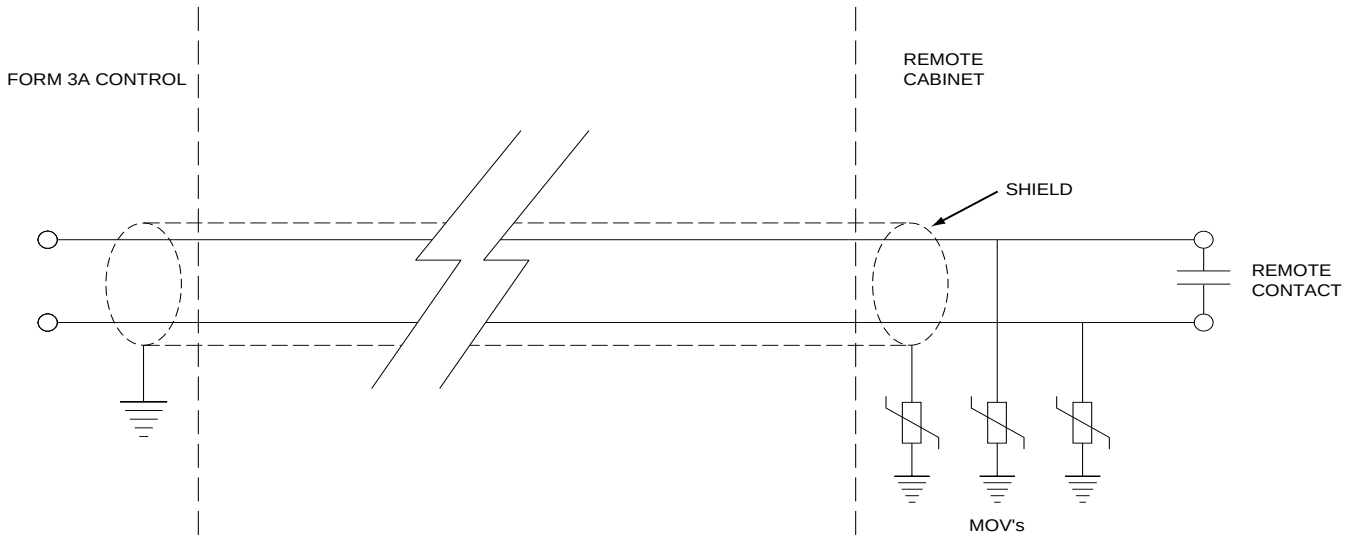


Figure 19.
Shielding and Surge Protection of Remote Cables.

Control Cable

A 7 ft. cable is furnished as standard with the control-recloser package. This length is sufficient for most substation mounting frame installations. For other installations, cable lengths as specified on the order are provided.

The cable is fabricated with connectors which mate with the female receptacle of the recloser on one end and the male receptacle of the control on the other.

Note: The control cable must be supported along its length to prevent repeated movement due to wind or other outside forces which can damage the cable.

Shielding and Surge Protection of Remote Cables

All remote operation and control monitor leads should be protected within shielded cables. This is particularly important if the remote cables are routed near other cables or devices that emit strong magnetic fields. The cable shield must be grounded at the Form 3A control only, see Figure 19.

Note: In order to protect a remote device(s) from high-voltage surges, all remote operation and monitor leads must be protected with metal oxide varistors (MOV's), see Figure 19. Use Harris V320LA40B varistors, (320 Vac, 160 J), or equivalent.

Customer Connections Terminal Strip

WARNING: Hazardous Voltage. The ac supply common lead must be connected to the terminal labeled COMMON AC GND. If supply connections are reversed, the control cabinet will be at ac supply potential. Improper connection of the control supply could result in contact with high voltage, which will cause death or severe personal injury. T219.2

All Form 3A controls require 120 Vac auxiliary power to operate the battery charger and energize the control cabinet heater; both are standard features of the control.

Auxiliary power connections and connections for remote operation of certain accessories are made on a 14 point terminal strip mounted vertically on the back panel of the control. Figure 20 shows two partial detail views of the terminal strip to indicate the customary connection terminals for the various accessories. However, deviations may occur to accomodate certain combinations of accessories. All terminals for required connections are clearly marked.

The minus side of the 24 Vdc control circuit is grounded to the cabinet at the input cable receptacle card in the bottom of the cabinet by a white jumper lead connected between tabs GND and BATT-. When an external dc power source accessory is used instead of the battery, remove the jumper to make sure there is no interaction between station ground and earth ground.

Note: A 27 ohm resistor on the receptacle card, in series with the grounding jumper lead, will limit the short-circuit current to nondestructive levels in case of momentary accidental grounding of the plus side of the circuit. A sustained short will cause the resistor to overheat and eventually burn out. This condition, however, will not affect control operation.

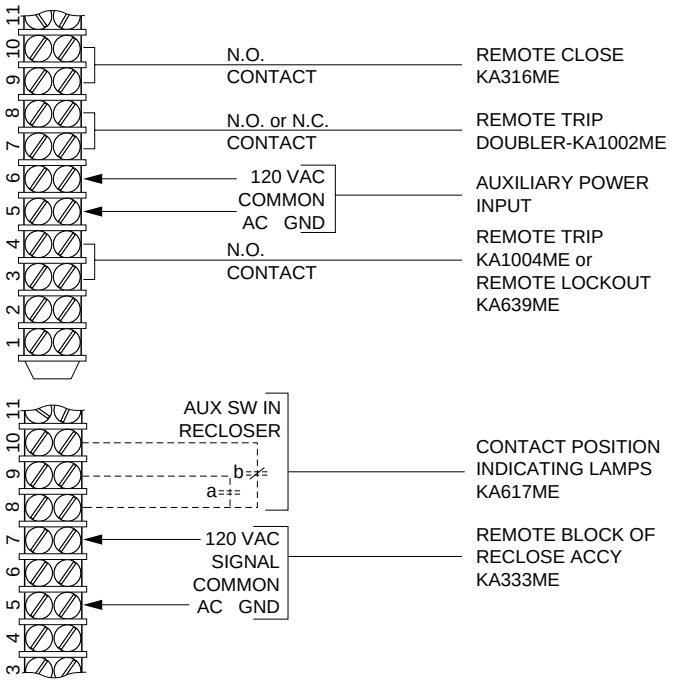


Figure 20.
Typical Accessory Locations on Customer Connections Terminal Strip.

Control / Recloser Interchangeability

Since a temperature-regulated, 120 Vac, potential-type battery charger is a standard feature of the Form 3A electronic control, the battery charger is not included as a standard feature of the companion electronically controlled reclosers. It is, however, available as a factory installed accessory for these reclosers. Care must be exercised when interchanging "new-style" controls (Form 3A) and "old style" controls (Form 3) with "new style" reclosers (without battery recharger) and "old style" reclosers (with battery charger as standard) to make sure that each combination has an operational battery charger.

The Form 3A control, or the Form 3 control equipped with a battery charger accessory, is compatible with all old- and new-style reclosers provided 120 Vac power is available at the control.

If 120 Vac is not available at the control, the Form 3A control can be made compatible with any old-style recloser by changing the connections on the input receptacle card as shown in Figure 21 to connect the battery charger in the recloser to the control.

911071KMA-F

Figure 21.
To use Charger in Recloser, Jumpers on Control Cable Receptacle Card must be changed.

If 120 Vac is not available at the control, the new-style recloser must be equipped with its battery charger accessory to be compatible with the Form 3A control. The combination of a Form 3 control, without the battery charger accessory, and a new-style recloser does not have an operational battery charger. To make this combination compatible, either the control or the recloser must be equipped with its battery charger accessory (depending on whether 120 Vac is or is not available at the control).

Tables 2 and 3 summarize the various recloser/control combinations.

Table 2
120 Vac Available At Control

Control	Recloser	Compatible?	Remarks
Form 3A (Above Serial No. 26000)	New Style (No Battery Charger)	Yes	
	Old Style (Battery Charger Std)	Yes	
Form 3 With Battery Charger Accessory (Below Serial No. 26000)	New Style (No Battery Charger)	Yes	
	Old Style (Battery Charger Std)	Yes	
Form 3 Without Battery Charger Accessory (Below Serial No. 26000)	New Style (No Battery Charger)	No	Add battery charger accessory to control.
	Old Style (Battery Charger Std)	Yes	

Table 3
120 Vac Not Available At Control

Control	Recloser	Compatible?	Remarks
All Form 3A	New Style (No Battery Charger)	No	Use recloser equipped with battery charger accessory; reconnect input receptacle card in control for recloser charging.
	Old Style (Battery Charger Std)	No	Reconnect input receptacle card in control for recloser charging.
Form 3 With Battery Charger Accessory (Below Serial No. 26000)	New Style (No Battery Charger)	No	Use recloser equipped with battery charger accessory; disconnect battery charger accessory in control; reconnect control for recloser charging.
	Old Style (Battery Charger Std)	No	Disconnect battery charger accessory in control; reconnect control for recloser charging.
Form 3 Without Battery Charger Accessory (Below Serial No. 26000)	New Style (No Battery Charger)	No	Use recloser equipped with battery charger accessory.
	Old Style (Battery Charger Std)	Yes	

For identification, Table 4 lists the serial number breaks between old-style and new-style reclosers. Below this serial number, the recloser is equipped with a battery charger as standard; above this serial number, there is no battery charger in the recloser.

Table 4
Serial Number Break for New Style Reclosers Without Battery Chargers

Recloser	Serial No.	Recloser	Serial No.
CXE	1100	VSAT	300
ME	650	VSML	325
MLE	470	VSMT	150
MVE	375	VSR	350
RVE	2500	VWE	2100
RXE	900	VWVE	1500
VSA	2925	WE	6800
VSO	100	WVE	1200

New-style reclosers without battery chargers are identified with the following instruction label prominently displayed on the sleet hood or the front of the operator cabinet:

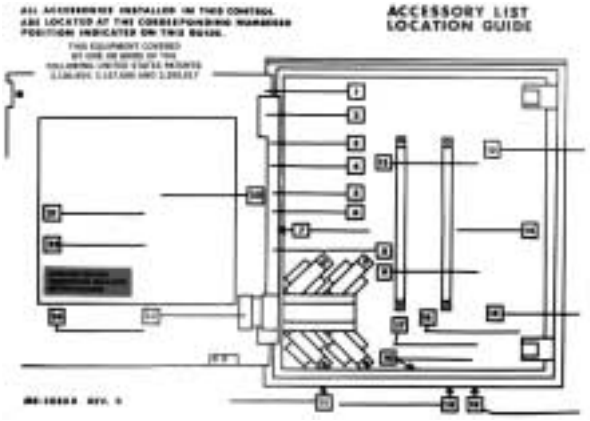
NO BATTERY CHARGER IN THIS RECLOSER. USE WITH FORM 3A OR CONTROL CONTAINING POTENTIAL BATTERY CHARGER.

If a new-style recloser is equipped with a battery charger, the following label is used:

THIS RECLOSER EQUIPPED WITH BATTERY CHARGER

Accessories

A number of accessories are available to further extend the operating flexibility of the Form 3A electronic control and broaden its application capabilities. The Accessory List Location Guide label attached to the inside of the cabinet door (Figure 22) lists the accessories included in the control, shows their approximate physical location, and identifies each accessory with a number corresponding to the index number on the label.



911072KMA-F

Figure 22.
Accessory Location Guide Label Mounted inside Cabinet Door Identifies and Locates all Control Accessories.

Separate *Service Information* bulletins provide the installation, operating, testing, troubleshooting instructions for the accessories furnished with each control.

Table 5 lists Form 3A control accessories, catalog numbers and *Service Information* bulletin numbers.

IMPORTANT: Although it may be desirable under certain conditions to operate control accessories in parallel from a single remote contact, this is generally not possible. Cooper Power Systems does not advise interconnection between controls because of possible control interaction.

! CAUTION: Equipment damage. Each remote operation accessory installed in the control requires two wires for operation. For example, if both remote close and remote lockout are installed, they require four wires. Using three wires will cause misoperation and/or control damage. T220.0

Verification Procedure Prior to Placing Control and Recloser into Service

Prior to placing the control and its recloser into service, make sure that all the following installation procedures have been properly completed and verified.

1. Control properly mounted for the installation.
2. Recloser installed according to all locally approved utility practices.
3. Control and recloser properly grounded in accordance with guidelines in this manual.
4. 120 Vac connected to control.
5. Control battery connected and tested for proper operation.
6. All control plug-in components properly installed and programming verified by appropriate personnel.
7. Customer connections for remote and supervisory operation checked and completed in accordance with shielding and surge protection instructions in this manual.
8. Control cable properly connected and supported.

Table 5
Form 3A Type ME Electronic Control Accessory Manuals

Accessory Catalog No.	Accessory Description	Service Information Number
KA333ME	Reclose-Blocking	S280-75-36
KA418ME7	Sequence Coordination	S280-75-37
KA531ME	Fuse Elimination	S280-75-44
KA542ME	Thermostatically Controlled Heater	S280-75-39
KA1002ME	Minimum-Trip Doubler	S280-75-21
KA1036ME	Instantaneous Lockout	S280-75-33
KA1037ME	Instantaneous Trip	S280-75-25
KA1119ME	Capacitor Backup Trip	S280-75-48
KA1137ME	Target Annunciator	S280-75-41
KA1163ME	Minimum Response Time	S280-75-42
KA2003ME	Remote Close with Cold Load Pickup	S280-75-49
KA2035ME2	Remote Non-Reclose and Ground Trip Block Maintained Contact	S280-75-52
KA2039ME	Recloser Status	S280-75-51
KA2047ME	Remote Battery Test and Voltage Monitor	S280-75-57
KA2070ME	Remote Close with Cold-Load Pickup, Remote Lockout, and Recloser Status	S280-75-55
KA2071ME	Remote Non-Reclose and Ground Trip Block Momentary Contact	S280-75-53
KA2072ME	Remote Battery Test and Voltage Monitor Analog Output	S280-75-56
KA2075ME	Closing Coil Control Fuse	S280-75-62
KA2272ME	Analog Current Metering	S280-75-63

TESTING PROCEDURES

Testing with Type MET Tester

The Kyle Type MET Electronic Recloser Control Tester (Figure 23) has been designed specifically for testing Form 3A controls. The MET Tester is completely self-contained, includes all necessary metering and interconnecting cables, and is capable of performing all required checks and tests from a simple verification of operation to a complete verification of operation of all operating parameters. Operating instructions for the Type MET Tester are contained in *Service Information S280-76-1.*

86841KMA-F

Figure 23.
Kyle Type MET Electronic Recloser Control Tester.

If an MET Tester is not available, the following test procedures, ranging in complexity from a simple check of coordinated control-recloser operation to a verification of the various control settings, may be performed:

- For a simple check of coordinated control-recloser operation, the output of a soldering gun (with the tip removed) connected across a minimum-trip resistor will provide a signal of sufficient strength to simulate a fault current and operate the control. Refer to the **Soldering-Gun Test** section in this manual**.**
- To verify minimum trip, timing, and operating sequence, an equivalent test current which simulates the output of the sensing CTs can be introduced directly into the control. Refer to the **Testing with Simulated Current** section of this manual.
- To verify the control settings and check the sensing CTs, a variable, low-voltage test current simulating fault conditions can be passed through one phase of the recloser. Refer to the **Testing with Low-Voltage Current** section of this manual.

Testing an Installed Control

A recloser control can be taken out of service for testing and placed back in service without deenergizing its recloser and interrupting the system. However, during the time the control is out of service, system fault protection is lost.

CAUTION: Recloser misoperation. The control must be removed from service prior to performing any maintenance, testing or programming changes. Failure to comply can result in misoperation (unintentional operation) of the recloser. T216.2

To Remove Control from Service

Prior to testing, changing plug-in components, performing control maintenance, making program changes, or battery replacement on an in-service control, the following steps must be taken to prevent possible recloser misoperation.

1. Switch Ground Trip Block switch to BLOCK.
2. Disconnect control cable from control.
3. De-energize potential battery charger, by opening the battery charger fuse block switch (shown in Figure 4.)
4. Operate the Manual Control switch to OPEN.
5. Unplug the control battery.

To Return the Control to Service

After required work is completed, return the control to service with the following steps:

1. Check that all plug-ins are properly installed and control settings are correct.
2. Connect control battery.
3. Close the battery charger fuse block switch to energize the potential battery charger.
4. Move Manual Control switch to CLOSE, to ensure that control is reset to the home position.
5. Reconnect control cable to control.
6. Switch Ground Trip Block switch to NORMAL.

Closing the Recloser

Electrical Closing - RVE, RXE, VWE, VWVE27, VWVE38, WE, and WVE Reclosers

For automatic operation, line voltage is required to operate the closing solenoid of RVE, RXE, VWE, VWVE27, VWVE38, WE, and WVE reclosers (except for reclosers equipped with the low voltage closing accessory).

WARNING: Hazardous voltage. Interconnect source leads X and Y and ground solidly to the recloser tank. Do not connect lead Z to any other phase or mechanical ground. Dangerous voltages to ground exist on the phase connected to lead Z. Solidly ground all equipment. Failure to comply can result in severe personal injury and/or equipment damage. T224.1

For on-line testing, bypass the recloser, open the load-side disconnects, but keep the source-side disconnects closed. This will remove the recloser from service, but will keep line voltage supplied to the closing solenoid. See Figure 24.

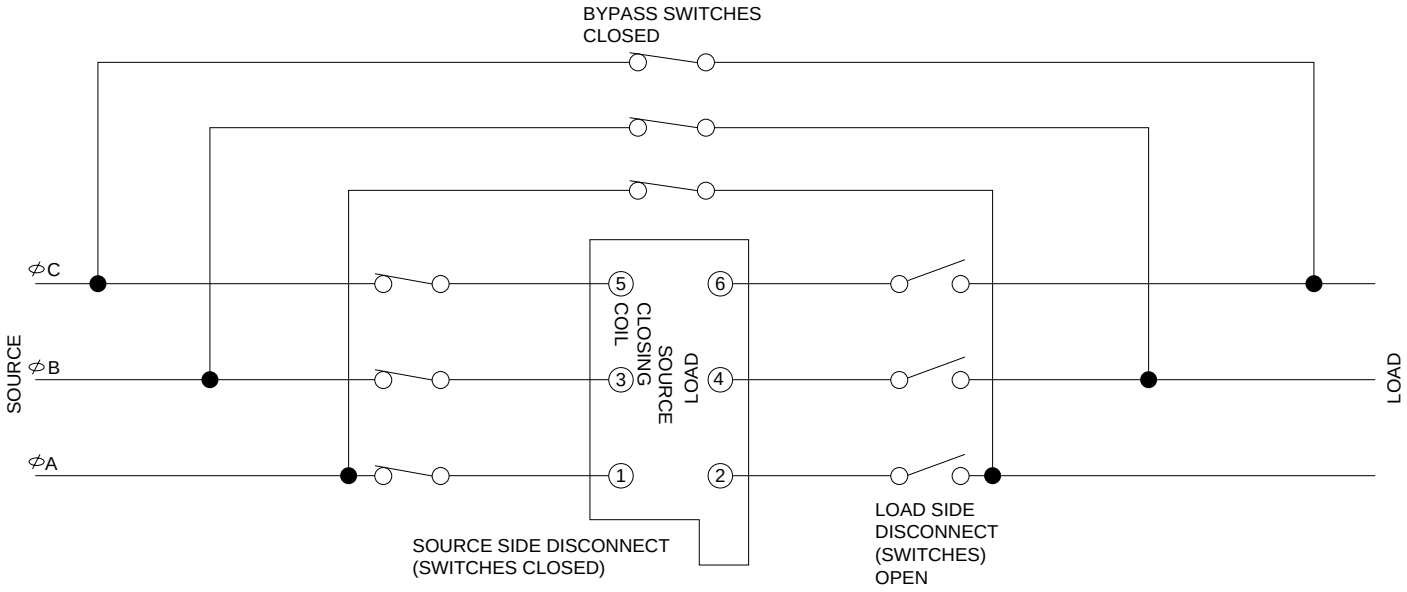


Figure 24.
Closing-Source Side Switches of a Bypassed, On-line Recloser will Provide Closing Solenoid Power for Automatic Operation During Testing.

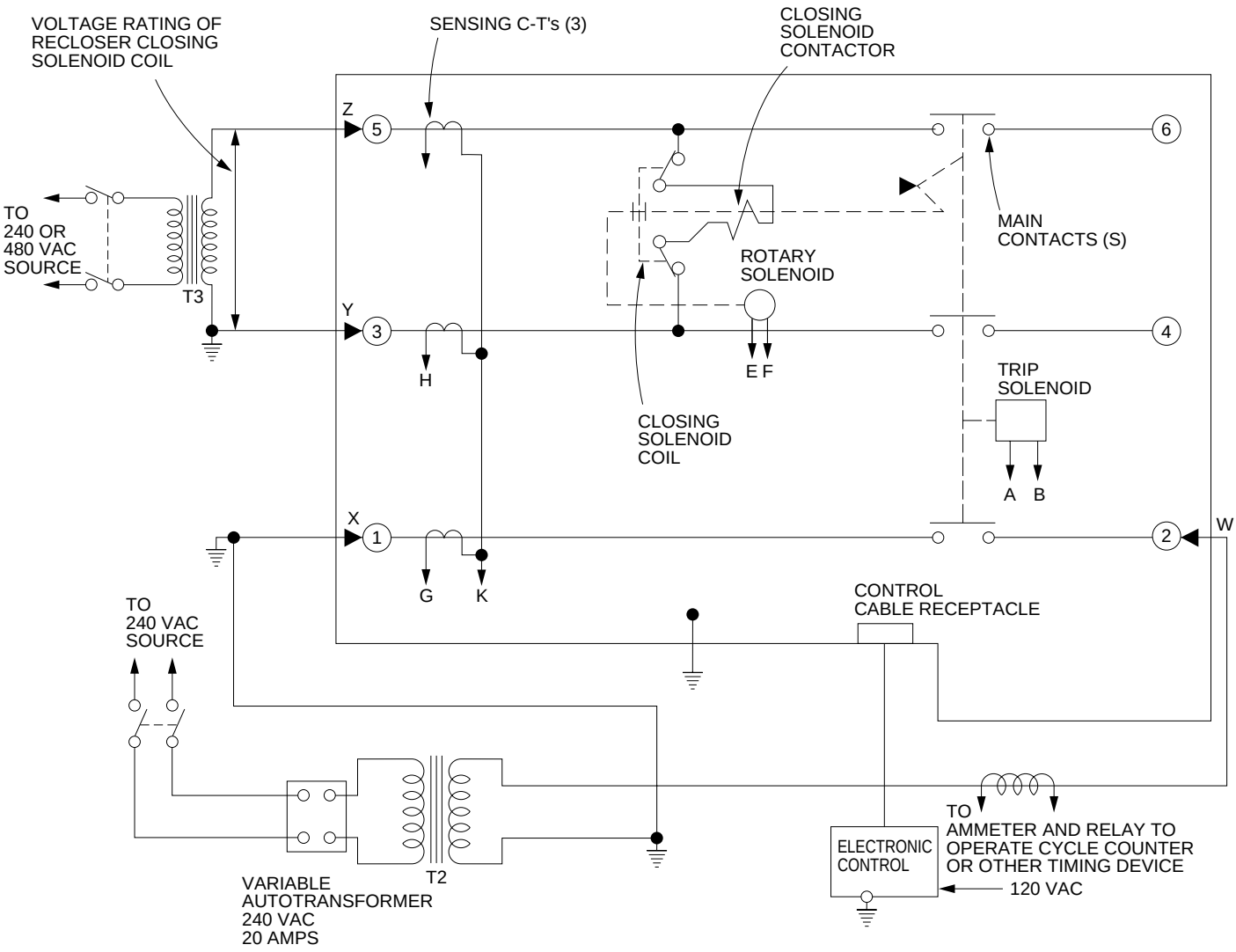


Figure 25.
Suggested Test Circuit for Solenoid Closing Reclosers.

WARNING: Hazardous voltage. The switchgear and high-voltage transformer must be in a test cage or similar protective device to prevent accidental contact with the high-voltage parts. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage. T221.3

For shop testing, the closing solenoid voltage can be supplied by back-feeding a transformer with a low-side rating equal to the voltage rating of an available power source and a high-side rating equal to the voltage rating of the recloser. This procedure is not to be used on reclosers equipped with the low-voltage closing accessory, see Figure 25. Make sure the solenoid coil operating voltage is maintained at the recloser bushings during the two-to-three cycle interval the closing coil is energized. In general, a 75 kVA transformer of the proper voltage rating with an impedance drop of about 3% will be satisfactory. The source impedance must also be reasonably low. The closing coil requirement is approximately 200 kVA during the two-to-three cycle closing operation.

Electrical Closing - CXE, VSA, VSO, and VSML Reclosers

CXE, ME, VSA, VSO, and VSML reclosers utilize a motor-operated closing mechanism which is energized from a 230 Vac power source; no high-voltage is required.

Manual Closing - Solenoid-Operated Reclosers

If high-voltage for operating the closing solenoid of RVE, RXE, VWE, VWVE27, VWVE38, WE, and WVE reclosers is not available, manual closing can be substituted for electrical closing; however, not all control settings can be checked since manual closing is not synchronized with the closing coil control circuit in the control.

IMPORTANT: If manual closing is not performed within the reclosing interval of the control, the closing coil control fuse will blow. To prevent this from occuring, remove the fuse during manual closing procedures.

To manually close the recloser:

! WARNING: Explosion Hazard. Excessive Contact Arcing. Do not use the manual closing tool to close an oil-insulated energized recloser. Closing an energized oil-insulated recloser with a manual closing tool can cause excessive contact arcing, rapid build-up of gas within the equipment, and possible explosion that can cause death, severe personal injury, and equipment damage. T203.2

1. Remove the closing tool port cover and gasket from the side of the recloser head casting.

! CAUTION: Equipment damage. Do not turn the manual closing tool more than one-quarter turn clockwise. Forcing the tool beyond the mechanism stop may shear the pin on the closing shaft of the recloser. T222.0

2. Insert the KA90R T-handled tool (available as an accessory) into the port, engaging the pin on the closing shaft. (Figure 26).
3. Close the recloser by placing the yellow operating handle (under the sleet hood) into the up or CLOSED position and turning the closing tool one-quarter turn clockwise.
4. After each trip operation, about ½ second will elapse while the closing solenoid plunger is moving upward to reset the main toggle latch.
5. After the main toggle latch resets, the recloser can be closed again by operating the manual closing tool.
6. Replace the gasket and port cover on the recloser head after testing has been completed.
7. Reinstall the control closing coil fuse.

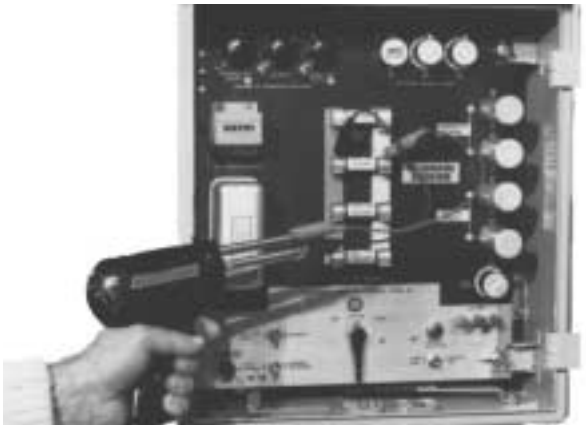
Soldering-Gun Test

The output of a soldering gun (Weller Model 550 or equivalent) will produce a signal of sufficient strength to simulate a fault and check recloser-control operation. To solder-gun test a control:

1. Set the Non-Reclose/Normal Reclose switch on the control to NORMAL reclosing and the Ground Trip Block switch to NORMAL.
2. Move the manual control switch on the control panel to TRIP, to open the recloser contacts.
3. Remove the tip from the posts of the soldering gun by loosening the hexagonal locking nuts.
4. Connect a short clip lead to each post and connect the soldering gun across the Phase A minimum trip resistor as shown in Figure 27.
5. Move the manual control switch on the control panel to CLOSE. The recloser should close.
6. Energize the soldering gun by depressing and holding the trigger until the recloser trips.
7. **Immediately** release the trigger to prevent instantanious trips on succeeding reclosings.
8. When the recloser recloses, again energize the soldering gun and repeat Steps 5 and 6 until the control locks out. Count the number of fast and delayed trip operations and compare the count with the control settings. Verify lockout with the switch on the operator panel.
9. Repeat on Phases B and C and Ground if desired.

82284KMA-F

Figure 26.
Using a KA90R Manual Closing Tool to Operate the Recloser.



82290KMA-F

Figure 27.
The Output of a Soldering Gun can be used for a Quick-Check of Control-Recloser Operation.

Testing with Simulated Current

The Form 3A electronic recloser control continuously monitors line current conditions with three wye-connected 1000:1 ratio current transformers mounted internally on the source-side bushings of the recloser. These CTs are connected directly to three wye-connected phase minimum-trip resistors on the control panel. A fourth resistor (ground trip) is connected in the CT neutral to monitor zero-sequence current flow.

The current through any one of the minimum-trip resistors is 1/1000 of the line current. Therefore, if 1/1000 of the line current is applied directly to the resistor, the control will operate as if line current was flowing through the CT primary and one milliamp of test current will be equivalent to one amp of line current.

Note: The above applies to all but the VSA20, VSO20 and the discontinued Type ME and VSMT reclosers. These higher continuous-current-rated reclosers use 2000:1 ratio sensing CTs and special blue label minimum-trip resistors. For Type VSA20 AND VSO20 reclosers, *one milliamp* of test current is equivalent to *two amps* of line current. When testing controls equipped with blue label trip resistors, double the milliamp reading to obtain the equivalent line current.

Test Equipment

A test circuit to produce a variable output in equivalent amps is shown in Figure 28. This circuit will provide a fairly complete test of the control and recloser. All parts are standard and can be purchased through any electronics supply outlet.

Note: High voltage is required to operate the closing solenoid of Type RVE, RXE, VWE, VWVE27, VWVE38, WE, and WVE reclosers, unless they are equipped with the low voltage closing accessory. A 240 Vac power source is required to operate the motor of CXE, VSA, VSO, and VSML Reclosers. Various closing schemes are discribed in the **Closing the Recloser** section.

WARNING: Hazardous voltage. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage. T223.2

Test Procedure

Coordinated Operation of Control and Recloser

1. Make certain that closing power is available at the recloser.
   - **A.** On solenoid-operated reclosers, move the yellow manual operating handle (located under the sleet hood) to the up position.
   - **B.** On motor-operated reclosers, move the TRIP-RESET lever or rod (located in the recloser operator cabinet) to RESET.
2. Set the operating mode switch on the control to NORMAL reclosing and the ground trip switch to NORMAL.
3. Move the manual control switch on the control panel to CLOSE. The recloser should close.
4. Move the manual control switch on the control panel to TRIP. The recloser should open.

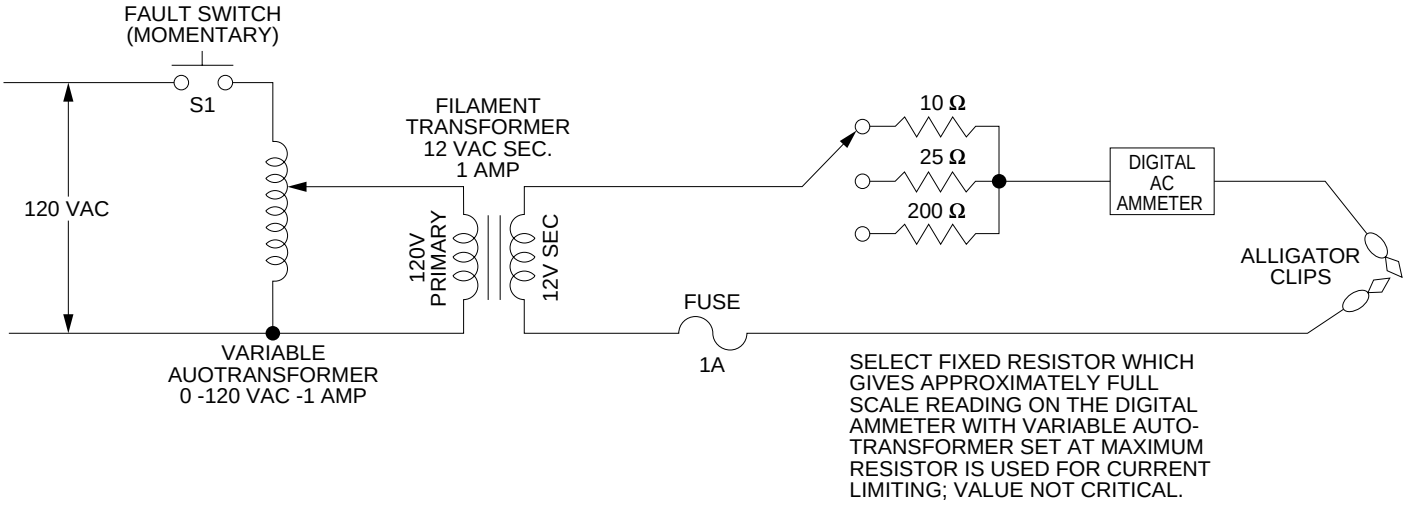


Figure 28.
Simulated Current Test Circuit.

Minimum-Trip Current

The minimum-trip current test should be performed on a fast time–current curve operation. The test will produce misleading results if the control is operating on a delayed TCC curve.

Note: If the control is equipped with the KA418ME7 sequence coordination accessory, refer to *Service Information S280-75-37* for additional information.

To test minimum-trip current:

1. Move the manual control switch to CLOSE to close the recloser.
2. Connect the output of the test circuit across the Phase A minimum trip resistor.
3. While holding fault switch S1 on the tester closed, slowly raise the test current from zero and note the meter reading when the recloser trips. This reading in milliamps should correspond to the trip resistor value in amps. For example, a 280 amp resistor should trip at 280 mA.
4. Release S1 before the recloser automatically recloses to prevent instantaneous trips on succeeding reclosings.
5. Repeat steps 1 through 4 for the Phase B, Phase C, and Ground trip resistors.

Trip Time

The trip times of the fast timing plugs (Sockets [1] and ◇1◇), are ordinarily too fast to check with a stopwatch with any accuracy. However, the delayed timing plugs (Sockets (2)) can be checked. To check the delayed timing plugs:

1. Move the manual control switch to TRIP to open the recloser.
2. Remove the RESET DELAY plug from the control panel.
3. Connect the output of the test circuit across the Phase A minimum trip resistor.
4. While holding Fault switch S1 closed, adjust the output to produce an equivalent test current of at least 150% of minimum trip. For example, a 420 mA test current for a 280 amp resistor.
5. Release S1 and move the manual control switch to CLOSE to close the recloser.
6. Close S1; the recloser should trip in a very short time.
7. Release S1 immediately and allow the recloser to close automatically.
8. Repeat Steps 6 and 7 for all fast operations to advance control operation to the delayed time-current curve.

   Note: The number of fast operations is determined by the setting of GROUND TRIP SOCKET [1] and PHASE TRIP SOCKET ◇1◇ switches in the upper left corner of the panel.

9. Close S1 and, at the same time, start a stopwatch.
10. When the recloser trips, stop the watch and release S1. Compare the time to the time at 150% of minimum trip on the published time–current curve for the timing plug being checked. For example, a B plug will clear in about 2.8 seconds at 150% minimum trip.
11. Repeat Steps 9 and 10 to lockout.
12. Repeat Steps 3 through 11 for the GROUND TRIP TIMING Plug (2).

Reclosing Time

To check reclosing time (the open interval of the recloser between trips):

1. Move the switch to CLOSE to close the recloser.
2. With the tester output connected across any one of the minimum-trip resistors and adjusted to produce an eqivalent test current of at least 150% of the minimum trip rating, close Fault Switch S1.
3. When the recloser trips, release S1 and start timing the interval the recloser is open, stopping when the recloser recloses. The time should correspond to the first RECLOSING INTERVAL DELAY plug setting.
4. Repeat Steps 2 and 3 to check the timing of the second and third RECLOSING INTERVAL DELAY plugs.
5. Replace the RESET PLUG on the control panel.

Reset Time – Timed from Successful Reclosure

Reset timed from a successful reclosure is standard on the Type ME Form 3A control. To check the reset time:

1. Move the manual control switch to CLOSE to close the recloser.
2. With the tester output connnected across any one of the minimum-trip resistors and adjusted to produce an equvalent test current of at least 150% of the minimun-trip rating, close Fault Switch S1.
3. When the recloser trips, release S1 and wait for the recloser to reclose automatically.
4. Start timing when the recloser closes and stop when the control resets automatically as indicated by an audible clicking as the sequence relay returns to home position.
5. The elapsed time should correspond to the setting of the RESET DELAY plug.

Reset Time-Timed From First Trip Operation

The Form 3A control can be converted to reset-timed-from-first-trip operation as described in the **Reset Delay Selector** section.

To check the timing of this reset mode:

1. Move the manual control switch to CLOSE to close the recloser.
2. With the tester output connected across any one of the minimum-trip resistors and adjusted to produce an equivalent test current of at least 150% of the minimum-trip rating of the resistor, close Fault Switch S1.
3. When the recloser trips, release S1 and start timing.
4. Continue timing after the recloser automatically recloses until the control resets automatically as indicated by an audible clicking as the sequence relay returns to its home position.
5. The elapsed time should correspond to the setting of the RESET DELAY plug.

Operation of the Non-Reclosing Switch

The non-reclosing switch provides one-trip-to-lockout capability without disturbing the normal operating sequence of the control. To check its operation:

1. Move the non-reclosing switch to NON-RECLOSING.
2. Move the manual control switch to CLOSE to close the recloser.
3. With the tester output connected across any one of the minimum-trip resistors and adjusted to produce an equivalent test current of at least 150% of the minimum-trip rating of the resistor, close Fault Switch S1.
4. The recloser should trip once and not reclose. The control should indicate lockout position when the LOCKOUT TEST switch is operated.

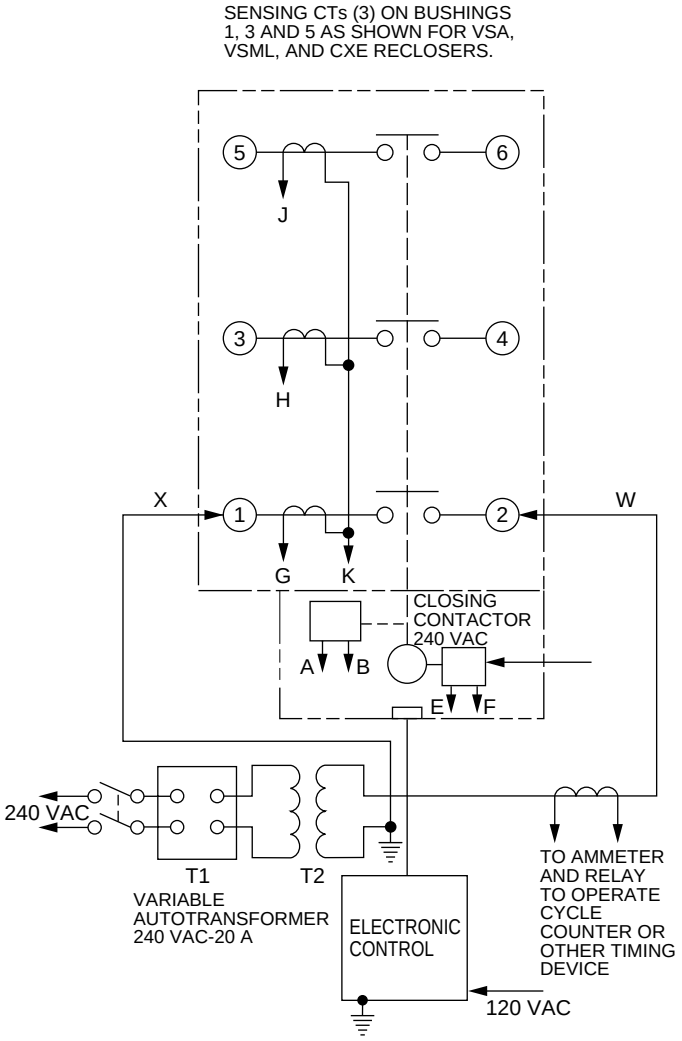


Figure 29.
Suggested Test Circuit for Motor Operated Reclosers.

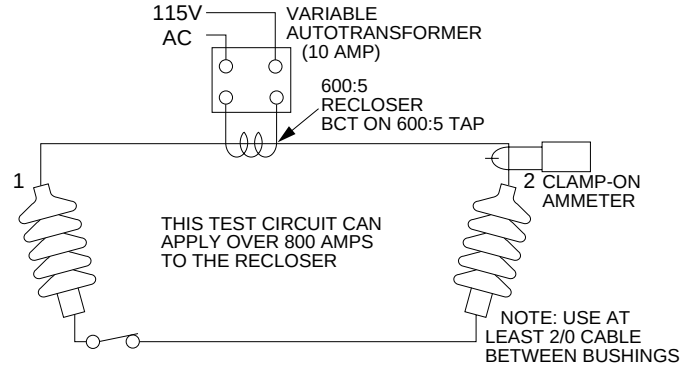


Figure 30.
Alternate Method of Producing Variable Line Current (Substitute for T2 and W-X Circuit in Figures 25 and 29).

Testing with Low-Voltage Current

The Form 3A recloser control-with its recloser-can be tested with a variable low-voltage current passing through one phase to simulate fault conditions.

Test Equipment RVE, RXE, VWE, VWVE27, VWVE38, WE, AND WVE Reclosers

! WARNING: Hazardous voltage. The switchgear and high voltage transformer must be in a test cage or similar protective device to prevent accidental contact with the high voltage parts. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage. T221.3

A test circuit for these solenoid-closed reclosers is shown in Figure 25. The following equipment is required for the recommended test setup:

Note: Solenoid-closed reclosers equipped with a 120- or 240-Vac low-voltage closing coil accessory can be tested as shown in Figure 29.

- Variable Autotransformer T1, 230 volts, 20 amps.
- Low-Voltage transformer T2 to simulate fault conditions.

  Ratio and size will depend upon the maximum current to be used. The recloser presents a low impedance to the transformer, so secondary voltage must be only high enough to force the required current through the secondary of the transformer and the recloser.

  Note: An alternative method of providing the necessary current through the transformer is shown in Figure 30.

- High-Voltage T3 to operate the closing solenoid. Refer to the **Closing the Recloser** section for high voltage transformer requirements.
- Ammeter with a rating based on the level of test current.
- Current-actuated timer or stopwatch.

Test Procedure

Test Current Applied to Phase A

! WARNING: Hazardous voltage. Interconnect Source Leads X and Y and ground solidly to the recloser tank. Do not connect Lead Z to any other phase or mechanical ground. Dangerous voltages to ground exist on the phase connected to Lead Z. Solidly ground all equipment. Failure to comply can result in severe personal injury and/or equipment damage. T224.1

1. Assemble and connect the equipment as shown in Figure 25, which shows the test current being applied to Phase A, the phase nearest the sleet hood.
2. Verify that closing power is available at the recloser.
3. Move the yellow manual operating handle, located under the sleet hood, to the UP position.
4. Set the Non-Reclosing/Normal Reclosing switch on the control panel to NORMAL RECLOSING and the Ground Trip switch to BLOCK.
5. Move the manual control switch to CLOSE. The recloser should close, indicating correct operation of the control and recloser.
6. Move the manual control switch to TRIP. The recloser should open, verifying the electrical operation of the trip solenoid and the mechanical operation of the trip mechanism.

Test Procedure

Test Current Applied to Phase B and C

! WARNING: Hazardous voltage. Dangerous voltages to ground exist on the phase connected to lead Z. De-energize high-voltage. Remove test leads Y and Z and solidly ground recloser tank prior to applying test current to phase B and C. Do not apply high-voltage to recloser while applying test current to phase B and C; transfer of high-voltage to low-voltage test circuitry will result. Failure to comply can result in death, severe personal injury, and/or equipment damage. T305

1. De-energize the high-voltage closing source and close the recloser manually before testing phase B and C. Refer to the **Manual Closing** procedure in the **Closing the Recloser** section of this manual.
2. Verify that closing power is available at the recloser.
3. Move the yellow manual operating handle, located under the sleet hood, to the UP position.
4. Set the Non-Reclosing/Normal Reclosing switch on the control panel to NORMAL RECLOSING and the Ground Trip switch to BLOCK.
5. Move the manual control switch to CLOSE. The recloser should close, indicating correct operation of the control and recloser.
6. Move the manual control switch to TRIP. The recloser should open, verifying the electrical operation of the trip solenoid and the mechanical operation of the trip mechanism.

Test Equipment CXE, VSA, VSO, and VSML Reclosers

A test circuit for these motor-operated reclosers is shown in Figure 29. Since these reclosers require only a 240 Vac source for closing, High-Voltage Transformer T3 and its associated protective cage is eliminated, but all other equipment is the same as the test equipment shown in Figure 25.

Test Procedure

Coordinated Operation of Control and Recloser

1. Assemble and connect the equipment as shown in Figure 29.
2. Verify that closing power is available at the recloser.
3. Move the TRIP-RESET lever or rod, located in the recloser operator cabinet, to RESET.

4. Set the Non-Reclosing/Normal Reclosing switch on the control panel to NORMAL RECLOSING and the Ground Trip switch to BLOCK.
5. Move the manual control switch to CLOSE. The recloser should close, indicating correct operation of the control and recloser.
6. Move the manual control switch to TRIP. The recloser should open, verifying the electrical operation of the trip solenoid and the mechanical operation of the trip mechanism.

Minimum-Trip Current

The minimum-trip test should be performed on a fast time–current curve. The test will produce misleading results if the control is operating on a delayed time–current curve.

Note: If the control is equipped with the KA418ME7 sequence coordination accessory, refer to *Service Information S280-75-37* for additional information.

To test the minimum-trip current:

1. Move the manual control switch to CLOSE to close the recloser.
2. With the test circuit connected to Phase A, energize T1, slowly raise the test current from zero, and note the meter reading when the recloser trips. This reading should correspond to the minimum current rating of the Phase A trip resistor.
3. After the recloser trips, turn T1 back to zero and move the manual control switch to TRIP to lockout the recloser.
4. Repeat Steps 1 through 3 for Phase B and Phase C trip resistors.
5. To check the minimum ground-trip resistor, place the ground-trip switch to NORMAL and repeat Steps 1 through 3.

IMPORTANT: Before checking the Phase B and Phase C trip resistors on solenoid-operating reclosers, de-energize the high-voltage closing source and close the recloser manually. Refer to the **Manual Closing** of the **Closing the Reclosers** section of this manual.

Note: The single-phase fault test current will appear as a phase-to-ground fault to the control. Therefore, when checking ground settings, jumper the minimum-trip resistor of the energized phase to block phase-trip operations.

Trip Time

If an electrically operated timer is used, both the fast and delayed time–current curves can be checked; however, the trip times of the fast timing plugs (sockets [1] and ◇1◇) are ordinarily too fast to check with a stop watch with any reasonable accuracy. To check the trip times:

1. Move the manual control switch to CLOSE to close the recloser.
2. With the ground-trip switch set on BLOCK, connect a short clip lead across the minimum-trip resistor of the phase being tested to prevent tripping of the recloser while the test current is being adjusted.
3. Energize T1 and adjust the current for 150% of minimum-trip rating.
4. Without disturbing the setting of T1, deenergize T1.
5. Remove the jumper from across the minimum-trip resistor.
6. Keeping T1 at the desired setting, energize T1 and record the tripping times as the recloser operates to lockout. These times should correspond to the times at 150% of minimum-trip on the published time–current curves for the timing plugs being checked. Delayed times can be measured with a stopwatch.
7. To check the ground-trip timing plugs, place the ground-trip switch to NORMAL and repeat Steps 1 through 6.

   Note: The single-phase fault test current will appear as a phase-to-ground fault to the control. Therefore, when checking ground settings, jumper to the minimum-trip resistor of the energized phase to block phase-trip operations.
8. Return the ground-trip switch to BLOCK after the test has been completed.

Reclosing Time

To check reclosing time, which is the open interval of the recloser between trips:

1. Move the manual control switch to CLOSE to close the recloser.
2. Energize T1 and adjust T1 to produce a current in excess of the phase minimum-trip value.
3. When the recloser trips, time the interval until the recloser recloses.
4. Time the second and third open interval in the same manner.
5. The times should correspond to the first, second, and third RECLOSING INTERVAL DELAY plug settings, respectively.

Reset Time Timed from Successful Reclosure

Reset timed from successful reclosure is standard on the Type ME Form 3A control. To check the reset time:

1. Move the manual control switch to CLOSE to close the recloser.
2. With T1 adjusted to produce a current in excess of the minimum-trip value, energize T1.
3. When the recloser trips, deenergize T1 and wait for the recloser to reclose automatically.
4. Start timing when the recloser recloses and stop timing when the control resets automatically as indicated by an audible clicking as the sequence relay returns to the home position.
5. The elapsed time should correspond to the setting of the RESET DELAY PLUG.

Operation of the Non-Reclosing Switch

The non-reclosing switch provides one-trip-to-lockout capability without disturbing the normal operating sequence setting of the control. To check its operation:

1. Set the non-reclosing switch to NON-RECLOSING.
2. Move the manual control switch to CLOSE to close the recloser.
3. With T1 adjusted to produce a current in excess of the minimum-trip value, energize T1.
4. The recloser should trip once, and the control should indicate lockout position when the LOCKOUT TEST switch is operated.

Testing RVE, RXE, VWE, VWVE27, VWVE38, WE, and WVE Reclosers with Manual Closing

Testing procedures for minimum-trip current, time–current curve time, reset time timed for successful reclose, reset time timed from first operation, and operation of the non-reclosing switch are the same as testing per the **Testing with Simulated Current** procedure section except for Type RVE, RXE, VWE, VWVE27, VWVE38, WE, and WVE reclosers. These reclosers will not close automatically. They must be manually closed after each trip operation.

For the **Manual Closing Procedure**, refer to the **Closing the Recloser** section of this manual.

When testing reclosers with manual closing, the following additional precautions must also be observed:

1. Since manual closing is not synchronized with the closing coil control circuit in the control, the control fuse will blow if manual closing is not performed within the reclosing interval. To prevent damage, remove the fuse during testing.
2. If the control is operating in the reset-after-first-trip mode, the reset-delay plug may be removed from the control for all testing except reset time timed from successful reclose and reset time timed from first operation. If the reset-delay plug is not removed, the control may reset before a test sequence is completed because of the possible delays between trip operations when manual reclosing is used.
3. The variable autotransformer must be kept energized at the proper setting while the recloser is closed manually. Setting it properly before manual reclosing is initiated assures accurate timing values.

MAINTENANCE INFORMATION

Maintenance Manuals

CAUTION: This equipment requires routine inspection and maintenance to ensure proper operation. If it is not maintained, it can fail to operate properly. Improper operation can cause equipment damage and possible personal injury. G105.1

Maintenance instructions for the Form 3A, Type ME control are included in *Service Information S280-75-2* and *S280-75-46.*

Replacement Parts

Replacement parts for Kyle controls are available through the factory Service Department. To order replacement parts, refer to the applicable maintenance manual and current Replacement Parts price list for catalog numbers and pricing. Contact your Cooper Power Systems Division sales representative for additional information and ordering procedures.

Repair Shops

Factory authorized repair shops are located throughout the continental United States to provide maintenance, repair, and testing services for Kyle controls and reclosers. For further information, contact your Cooper Power Systems Division sales representative.

Factory Maintenance Classes

The factory service department offers maintenance training courses for Kyle recloser controls. These classes, taught by experienced service technicians, are held at the factory's in-house training facility. For additional information, contact your Cooper Power Systems sales representative.

Video Cassette Training Program

A 29-minute video tape program; *KSPV3 Kyle Type ME control, Form 3A, Description and Operation* is available as a supplemental training aid for operating and service personnel.

This video program, developed for use in the factory training school, is designed to be used in conjunction with existing service literature. For additional information, contact your Cooper Power Systems sales representative.

COOPER Power Systems

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